

INFORMATION EXTRACTION FROM THE THEORETICAL PERSPECTIVE

M.T. IPALAKOVA

International University of Information Technologies
Department of Information Technologies
Manas Street 34A, 050040, Almaty, Kazakhstan,
e-mail: m.ipalakova@iitu.kz

ABSTRACT

In this article the information extraction field of study is discussed. Such aspects like its place in the text mining pipeline, the definition, the history of establishing the evaluation process are considered in detail. The comparisons of two extraction approaches and architectures for the information extraction systems design are presented.

Key words: information extraction, information extraction systems, entities, events, relations, knowledge engineering and machine learning approaches, precision, recall, evaluation conferences.

1. INTRODUCTION

Nobody will contradict the statement that we live in the Information Age. Information per se, information technologies in general, the Web and the Internet in particular have totally changed the way we work, study and communicate. There is an enormous amount of information on the Web which is available now for almost anyone. According to Moens [13] there have been several attempts to estimate how much information the Web contains. Even though it is obvious that such kinds of measurements are very rough and approximate, they allow us to gain general understanding of the volume of available data and predict that if the trend remains the same we will have to estimate the information in yottabytes (1 yottabyte is equal to 2^{80} bytes) in the near future.

However, the amount of accessible information would not be of much use if there were no suitable techniques to process it and extract knowledge from it. Thus, text mining is one of the technologies which are employed for those purposes. It can be described as a process of identifying the unknown information from a variety of unstructured data sources with a goal of further analysis of the derived facts.

In the context of text mining technology information extraction can be classified as one of the pre-processing tasks which are used in order to make data ready for applying major text mining techniques. These pre-processing operations involve processing the input, unstructured information in the form of documents, and presenting it in a more structured way to make further post-processing analysis possible.

2. DEFINING INFORMATION EXTRACTION

Despite the fact that information extraction is generally considered as a link in the chain of text mining techniques, it is a powerful and self-dependent technology.

There are a lot of situations when information must be analysed somehow but it is available primarily only in the form of natural text, such as technical reports, scientific articles, log records, news,

ANALYTICAL MANAGEMENT

etc. For instance, a hospital wants to produce its own statistics about the most commonly encountered diseases within the age and gender groups of patients. But the data they need is mostly stored in medical records in textual form. Another example can be provided from a business area. A particular company or business agency wishes to know the tendency of enterprises' bankruptcies by industries. That kind of information can be taken only from news reports. In both cases the information extraction is able to help and accomplish those kinds of tasks avoiding people to process large amounts of text documents by hand. It reduces the amount of information to be analysed by extracting useful facts and ignoring irrelevant ones. Derived data is presented then in a more structured database way when it is easily accessible for applying different analysing techniques [9, 10].

In order to explain the term information extraction, definitions from the different authors, namely Moens [13], Cowie and Lehnert [2], Grishman [9], Turmo et al. [14], have been examined. As soon as there is no classical definition for information extraction every author defines it in the way which he or she believes explains information extraction in the better way. Here is the definition of information extraction we have come up with taking into account the considerations of the authors mentioned above. It is defined in a more simplified way but without losing its core idea and aims. Information extraction is the identification and selection of the named entities relevant to the specific task, of the relationships between them and events in which they participate in the natural language text in order to make them more accessible for further manipulations.

3. THE OVERALL PROCESS OF INFORMATION EXTRACTION

Analysing the process of information extraction it is become obvious that different authors divide it in different steps of different granularity, combining them into bigger stages and assigning the components of the information extraction systems to accomplish the tasks involved (1, 2, 6, 9, 11, 14). However, analysing those different approaches the general pipeline of the information extraction process can be summarised and six main stages can be determined as following:

1. **Initial processing** which includes splitting a text into the fragments which are defined like zones, sentences, segments or tokens. This procedure can be performed by the components named as tokenisers, text zoners, segmenters or splitters. As Appelt and Israel [1] stated, tokenisation is a quite straightforward task for the texts in any European language, where the blank space between characters and punctuation indicate the boundaries of a word and a sentence respectively. But, for example, for Chinese or Japanese texts, where the boundaries are not so obvious this operation is not the simple one and requires much more effort to fulfill it. The next task within this stage is usually the morphological analysis which includes part-of-speech tagging and phrasal units (noun or verb phrases) identification. Part-of-speech tagging might be helpful to the next step which is the lexical analysis. It handles unknown words and resolves ambiguities. In addition, the lexical analysis involves working with the specialised dictionaries and gazetteers, which are composed of different types of names: titles, countries, cities, companies and their suffixes, positions in a company, etc. If a word in a document is found in a gazetteer it is tagged with the semantic class the word belongs to. For example, a word "Mr" will be tagged with the semantic class "Titles" [11, 14].

2. **Proper names identification** (names of people or organisations, dates, currency amounts, locations, addresses, etc.) is one of the most important operations in the chain of information extraction. Proper names can be encountered in almost all types of texts and usually they constitute the part of the extraction scenario. These names are recognised using a number of patterns which are called regular expressions [6].

3. **Parsing.** During this stage the syntactic analysis of the sentences in the documents is performed. After the previous step, where the basic entities were recognised the sentences are parsed to identify the noun group around some of those entities and verb groups. This parsing stage must be done in order to prepare the ground for the next stage of extraction relations between those entities and events in which they participate. The noun and verb groups are used as sections to begin to work on at the pattern

matching stage. The identification of those groups is realised by applying a set of specially constructed regular expressions [6, 9].

4. **Extraction of events and relations.** Everything which is done previously is basically the preparation for the major stage of extraction of events and relations, which are particularly related to the initial extraction specifications given by a client. This process is realised by creating and applying extraction rules which specify different patterns. The text is matched against those patterns and if a match is found the element of the text is labelled and later extracted. The formalism of writing those extraction rules differs from one information extraction system to another [1, 6, 9].

5. **Anaphora resolution.** Any given entity in a text can be referred to several times and every time it might be referred differently. In order to identify all the ways used to name that entity throughout the document coreference resolution is performed. Coreference or anaphora resolution is the stage when for noun phrases it is determined if they refer to the same entity or not. The most common types are pronominal and proper names coreference, when a noun is replaced by a pronoun in the first case and by another noun or a noun phrase in the second one [1, 6].

6. **Output results generation.** This stage involves transforming the structures which were extracted during the previous operations into the output templates according to the format specified by a client. It might include different normalisation operations for dates, time, currencies, etc. For instance, a round-off procedure for percentages can be executed [11, 14].

Not all of the tasks must be necessarily accomplished within one information extraction project. Therefore, a particular information extraction system does not have to have all of those possible components. According to Appelt and Israel [1] there are several factors that affect the choice of systems' components, like:

- Language. For processing texts in Chinese or Japanese languages with not clear word and sentence boundaries or texts in German language with words of a difficult morphological structure some modules are definitely necessary compared to working with English documents.
- Text genre and properties. In transcripts of informal speech spelling mistakes might occur in addition to implicit sentence boundaries. If information must be extracted from such texts those issues must be taken into account and addressed while designing a system by adding corresponding modules.
- Extraction task. For an easy task like names recognition the parsing and anaphora resolution modules might not be needed at all.

4. SOFTWARE ARCHITECTURES FOR INFORMATION EXTRACTION SYSTEMS DESIGN

In order to create an information extraction system the components which perform the stages mentioned above must be gathered into one pipeline. At the earliest stages of the development of information extraction as a field of study research groups designed information extraction systems from scratch every time they faced a different extraction problem. That was partly because at that time the major task was to solve the extraction problem and reusability of the tools created was not considered at all. Later, when the need for the integration of the tools developed by different groups was realised it was almost impossible to accomplish that task because of the diverse programming platforms used and the fact that the tools were not meant to be used in another application [12].

Since then several architectures have been developed to facilitate the process of the information systems development by providing the common platform for systems' components design, integration and reuse. Among them are the Unstructured Information Management Architecture (UIMA), the General Architecture for Text Engineering (GATE), the Architecture and Tools for Linguistic Analysis Systems (ATLAS), the Automated Linguistic Processing Environment (ALPE) [4]. Employing either of them it is possible to:

- Reuse the tools for natural language processing and text mining which have been previously created by other developers.

ANALYTICAL MANAGEMENT

- Quickly combine different tools and thereby analyse possible approaches to design of the language processing software.

The first two architectures (UIMA and GATE) are the most prominent and provide almost the same capabilities.

UIMA was created by IBM and then became an Apache open-source project. Both Java and C++ frameworks are available. One of the major distinguishing features of UIMA is a Common Analysis Structure (CAS) which represents an original document and its stand-off annotations. Thus, the UIMA processing engine works as following. A CAS Initialiser acquires raw documents through the Collection Reader interface and produces the initial CASs. Then Text Analysis Engines (such as language translators, grammatical parsers or document classifiers) perform the document-level analysis, modify the CASs and transfer them to the CAS Consumers. The latter in their turn execute the collection-level analysis. It can be said that the main interface within the UIMA processing engine takes CASs as input and returns them as output [7].

GATE is an open-source architecture written in Java which was created by the University of Sheffield. One of the main elements of GATE is the GATE Document Manager (GDM). The GDM model includes three elements: a collection with documents which contain texts and annotations upon them. Thus, the GDM stores all the information about the texts which is produced by the system. All the components of the system interact with each other only through GDM which decreases the number of communication interfaces to one. CREOLE, a Collection of Reusable Objects for Language Engineering, is the GATE element which performs all the tasks of text analysis [3].

In the case of UIMA the unstructured data sources can be not only just plain text or HTML page, an audio or video streams can be processed as well. GATE in its turn supports XML, HTML, RTF, SML formats and plain texts [4]. Both GATE and UIMA have the graphical user interface for tools searching, browsing and integration. To upload an existing text analysis tool to the collection of predefined components existing within the both architectures a wrapping procedure must be performed. To be integrated into UIMA a tool must be written in C++, Java, Perl Python or TCL. The C/C++, Java, TCL, Prolog, Lisp and Perl tool's implementations are right for GATE [3, 12].

Thus, with the advent of such common frameworks as UIMA and GATE a huge step forward has been made in the development of the text mining technologies in general and in the information extraction area in particular. The latter has become more efficient since the researchers can draw on the other researchers' successful experience and have a platform for quick systems design.

5. TWO EXTRACTION APPROACHES

No matter which architecture is used to combine the components of the information extraction system it supports one of the two basic approaches of extraction, namely, Knowledge Engineering Approach and Automatic Training Approach.

Knowledge engineering approach. In order to extract information from available texts using a system which supports a knowledge engineering approach a set of extraction rules must be written manually. A person who creates such a type of system, or is responsible for writing those rules (knowledge engineer) must be an expert in the knowledge domain chosen for extraction. Apart from that, a designer must know the formalism for writing those rules for the particular system used. Usually the knowledge engineer has a number of texts which are related to the chosen domain. Analysing those texts the designer finds common patterns in them and writes the rules using his or her intuition, which according to Appelt and Israel [1] is a very important factor in creating a system with a high level of performance. The rules are then interpreted by the components of the information extraction system and useful facts are found and extracted from the texts. Creating an information extraction system using this approach is a highly time and effort consuming iterative process. Firstly, the knowledge engineer writes a particular rule. Then he applies it to the available texts and checks whether it works correctly or not.

ANALYTICAL MANAGEMENT

Modifications are done if needed and the rule is examined again until a desirable result is achieved. Since this approach involves writing rules, in some sources it is called as a rule-based approach.

Automatic training approach. In this case there is no need to design extraction rules manually. Therefore a person who is responsible for the information extraction process does not have to know how to write rules and how a system works. A machine learning algorithm implemented in the information extraction system creates those rules. In order to do that the algorithm must have access to a large number of training texts related to the chosen domain. Those texts must be annotated manually in advance to provide examples on which the algorithm can learn and produce extraction rules. Thereby, the engineer must provide the set of training documents and be able to annotate them. Among algorithms that can be used for the automatic training approach there are decision trees, maximum entropy models and hidden Markov models [1]. In many sources this approach is named as the machine learning approach. The development of this method allows the information extraction area to become less domain-independent since the same machine learning algorithm can be applied to different domains as long as corpora of domain-related texts are available.

However, it is not necessary to create all the components of an information extraction system using only one particular approach. It is quite possible to interchange these two approaches while building different components of the system. One of the reasons of having such a possibility is that one can never say objectively which approach is better. Both of them have their advantages and disadvantages.

As Appelt and Israel [1] stated, the systems which use a knowledge engineering approach show a higher performance compared to the other ones. However, they require a lot of effort and time and depend on the knowledge engineer's skills and experience and availability of linguistic resources. The very important advantage of a machine learning based system is that it can be transferred to a different domain easily as long as specific texts and a person who can annotate them are available. But sometimes those texts are problematic or expensive to obtain or there is a lack of useful documents on which an algorithm can learn, and manual (or even machine-aided) annotation on the scale needed to provide reasonable levels of performance may be expensive.

On the basis of analysing the benefits and drawbacks of both approaches it is possible to conclude with the criteria which determine the choice of one of them. The most important condition to choose the automatic training approach is the presence of a set of suitable texts which can be used to train the algorithm. In the case of the knowledge engineering approach the availability of a person who is experienced in writing extraction rules is the most crucial criterion. Other aspects which can be considered are the specifications and the level of performance. If the specifications are subject to change and the level of performance is desired to be as higher as possible it is more reasonable to apply the rule-based approach, otherwise machine learning mechanisms can be employed.

6. INFORMATION EXTRACTION SYSTEMS EVALUATION

One of the ways to compare the extraction approaches is to measure the level of performance of the systems which support them. Message Understanding Conferences or Message Understanding Competitions (MUCs) have played an important role in the establishing of metrics to evaluate the information extraction systems. This conference was initiated by the United States Naval Ocean Systems Centre (NOSC) and was sponsored by the Defence Advanced Research Project Agency (DARPA). MUCs took place seven times from 1987 until 1998. Although the event is called a "conference", it can be described with other words like "competition" between information extraction research groups or "evaluation" of their systems' performances [2, 8, 14].

The major aim of these conferences was the evaluation of the state-of-the-art in the information extraction area, discovery and promotion of the new approaches in this field. However, Grishman and Sundheim (1996) claimed that MUCs differed from any other conferences in the way how the research groups were selected in order to take part in those conferences. The evaluation procedure started approximately 6 months before each conference. The research teams were given the same task to extract particular information from the sample texts. From year to year the tasks and domains were changed. The

ANALYTICAL MANAGEMENT

research groups had to develop information extraction systems to accomplish those tasks. Just before the conference the participants were given a number of test texts to be processed using their systems. Then the obtained results from researchers were evaluated and compared with the pattern which had been gained previously by hand [8, 14].

The domain for the first conference was Naval Tactical Operations. Starting from MUC-2 different domains was explored, such as reports about Joint Ventures, Terrorist Attacks and Airplane Crashes. For the second conference, the same area of military messages as for the first one was chosen but the particular task identified by the organisers was to fill in a template with 10 slots for information to be extracted. From conference to conference, new tasks were introduced and they became more complex; the number of slots to be filled in increased constantly and texts in Japanese language were used alongside documents in English [14].

The MUCs showed that information extraction is not an easy task, as it is very difficult to create a system with an accuracy level of 100%. This means there is always relevant information in the text which is not extracted and extracted entities in the slots which are not relevant to the task. To evaluate information extraction processes the two metrics, namely, Precision and Recall were established. In simple terms, Precision (P) is the proportion of correctly extracted entities (N_{correct}) to the total number of extracted entities (N_{response}). Recall (R) is the proportion of correctly extracted entities (N_{correct}) to the total number of entities which are extracted manually (N_{key}). Thus,

$$P = \frac{N_{\text{correct}}}{N_{\text{response}}}, \quad R = \frac{N_{\text{correct}}}{N_{\text{key}}}.$$

Another way of representation of information extraction systems evaluation is based on the notion of true and false positives and true and false negatives. It can be said that correctly extracted entities are true positives, whereas false positives are wrongly extracted information. Similarly, false negatives are relevant but not extracted information which is left in the text; true negatives are the information which is not extracted and not relevant to the task [1, 9]. Recall can be described as the measure of extraction effectiveness, whereas precision is the measure of extraction purity. Both of them are desired to be high. However, they are mutually dependent. If one of the metrics is increasing it leads to another metric decreasing and this trade-off is unavoidable.

In order to combine precision and recall, the F measure was introduced in one of the MUCs. Thus,

$$F = \frac{(\beta^2 + 1)PR}{\beta^2 P + R}, \quad 0 < \beta \leq 1.$$

It is the harmonic mean of two metrics which allows comparing and assessing different information extraction systems using one common base. Different values for β are used to, e.g., favour precision over recall [1, 14].

The work that had been done through all the MUCs led to the formulation and introduction of basic extraction tasks. MUC-6 and MUC-7 contributed the most to this process. The Named Entity Recognition (NER) task is the first step of any information extraction system which involves proper names and quantities identification. The techniques used to accomplish this task are well-understood now and NER can be considered as a more or less “solved problem”. The Template Element task (TE) is the next step to identify not only names but the descriptions of those names as well. The Template Relationship (TR) task implies finding the relationships between the entities extracted during the previous tasks. The Scenario Template (ST) task is based on the extraction according to the description of the particular event. The goal of the final Coreference task (CO) is to determine all the nouns, pronouns and noun phrases that refer to the same entity [8, 14].

After the last Message Understanding Conference 7 in 1998, the evaluation of information extraction systems has not stopped. MUC has been followed by the Automatic Content Extraction (ACE) programme since 1999. However, ACE is not just a copy of MUC; it differs from its predecessor in the following several ways [5]:

ANALYTICAL MANAGEMENT

- ACE defined 3 main extraction tasks different from those of MUC. The tasks are: Entity Detection and Tracking, Relation Detection and Tracking, Event Detection and Characterisation. The first task involves the extraction not only of the name of an entity but anything that refers to that name, such as a description or a pronoun. That is why it is possible to say that the Entity Detection and Tracking task has combined the Named Entity Recognition and the Coreference Tasks of MUC.

- Not only English language texts, but texts in Arabic and Chinese are processed as well.
- Not only text documents but audio and image data are used to extract information from.
- Until 2008 the evaluation results had not been published. In 2008 the official results of ACE were made publicly available for the first time [15].

- The systems are evaluated using a Value measure which shows the correctly detected and recognised objects and their attributes. It is applied for all of the tasks and target objects, namely, entities, relations and events.

7. CONCLUSION

Information extraction is a relatively new area of study. However, as any information technology it advances quite quickly and a great progress has been made from the time it appeared. Texts from different domains were processed within the MUC and ACE competitions and the performance, for example, in the named entity recognition task has reached higher than 90% level. The process of the information extraction system design has changed from independent development of a system for a particular task from scratch to application of architectures like UIMA and GATE which allow using the previously created components and combining them easily.

However, there are still many unsolved problems. Event extraction task, for instance, cannot be executed as yet with as high level of performance as named entity recognition. And domain-independent information extraction systems are still one of the big research issues.

REFERENCES

- [1] Appelt D., Israel D. (1999) Introduction to Information Extraction Technology: IJCAI-99 tutorial <<http://www.ai.sri.com/~appelt/ie-tutorial/IJCAI99.pdf>> (Accessed on 10/04/11).
- [2] Cowie J., Lehnert W. (1996) Information Extraction, *Communication of the ACM*, 39(1), pp. 80-91.
- [3] Cunningham H. (2002) GATE, a General Architecture for Text Engineering, *Computers and Humanities*, 36(2), pp. 223-254.
- [4] Dietl R., Hoisl B., Wild F., Richter B., Essl M., Doppler G. (2008) Project Deliverable Report. Deliverable D2.1 – Services Approach & Overview General Tools and Resources.
- [5] Doddington G., Mitchell A., Przybocki M., Ramshaw L., Strassel S., Weischedel R. (2004) The Automatic Content Extraction (ACE) Programme – Tasks, Data and Evaluation, *Proceedings of the Conference on Language Resources and Evaluation*.
- [6] Feldman R., Sanger J. (2007) *The Text Mining Handbook: Advanced Approaches In Analysing Unstructured Data*. New York: Cambridge University Press.
- [7] Ferrucci D., Lally A. (2004) UIMA: an Architectural Approach to Unstructured Information Processing in the Corporate Research Environment, *Natural Language Engineering*, 10(3/4), pp. 327-348.
- [8] Grishman R., Sundheim B. (1996) Message Understanding Conference – 6: A Brief History, *Proceedings of the 16th conference on Computational Linguistics*, 1, pp. 466-471.
- [9] Grishman R. (1997) Information Extraction: Techniques and Challenges. In: Pazienza, M.T. (ed.) *Information Extraction: A Multidisciplinary Approach to an Emerging Information Technology*. Berlin, Heidelberg: Springer-Verlag, pp. 10-27.
- [10] Grishman R. (2003) Information Extraction. In: Mitkov, R. (ed.) *The Oxford Handbook of Computational Linguistics*. Oxford: Oxford University Press, pp. 545-559.

ANALYTICAL MANAGEMENT

- [11] Hobbs J.R. (1993) The Generic Information Extraction System, Proceedings on the 5th Conference on Message Understanding, pp. 87-91.
- [12] Kano Y., Nguyen N., Sætre R., Yoshida K., Miyao Y., Tsuruoka Y., Matsubayashi Y., Ananiadou S., Tsujii J. (2008) Filling the Gaps between Tools and Users: A Tool Comparator, Using Protein-Protein Interaction as an Example, PSB 2008 Online Proceedings <<http://psb.stanford.edu/psb-online/proceedings/psb08/kano.pdf>> (Accessed on 10/04/11).
- [13] Moens M.-F. (2006) Information Extraction: Algorithms and Prospects in a Retrieval Context. Springer Netherlands.
- [14] Turmo J., Ageno A., Catala N. (2006) Adaptive Information Extraction, ACM Computing Surveys, 38(2), pp. 1-47.
- [15] NIST 2008 Automatic Content Extraction Evaluation (ACE08). Official Results. Date of Release: September 29, 2008 <http://www.itl.nist.gov/iaui/894.01/tests/ace/2008/doc/ace08_eval_official_results_20080929.html> (Accessed on 10/04/11).

IMPLEMENTATION OF INFORMATION SYSTEM OF ENFORCEMENT IN BULGARIA, ACCORDING TO THE LAW ON PRIVATE ENFORCEMENT



**MARIANA MATEEVA
PETROVA^A,
STEFAN VALERIEV
VARBANOV^B**

^{a)} *University of Veliko Turnovo "St. Cyril and St. Methodius", 32, Al. Burmov str., Veliko Turnovo 5000, Bulgaria*
e-mail: petrova_mariana@abv.bg, phone: +359 886842129

^{b)} Bulgarian Ministry of Justice – external OPAC projects expert,
e-mail: varbanov_stef@mailcity.com, phone: +359 889200886

ABSTRACT

In 2008 the Council of the European Union has developed and adopted a multi-year action plan for the period 2009-2013 in the European e-Justice. The European e-Justice must fulfil three basic functions in terms of access to information in the field of justice, electronic communication between the court and the parties concerned, and to simplify and promote the exchange of information between judicial authorities in the Member States. In view of this development and implementation of an information system of enforcement is crucial, not only the expected effect on the affected public relations internally, but also as a means of fulfilling the obligations imposed as a result of Bulgaria's membership in the EU. No doubt the importance of the reform is based on the consistent application of a number of measures, the result of which should give the public a quick, transparent and effective functioning justice system.

Key words: Information system, e-Justice

1. INTRODUCTION

E-Justice is not a single act or a state of the judicial system - this is a process that involves a set of measures associated with the reorganization of the judicial system of using modern information technologies - legal, technical, organizational, financial and educational.

In accordance with the Law on the Judicial System Act (JSA) and the Private Enforcement Agents (Agents Act), the Ministry of Justice (MOJ) together with the Inspectorate of the Ministry of Justice, the Judiciary Act are required to monitor the activity on the formation, movement and closure of enforcement cases of public enforcement of private bailiffs. These institutions are ought to summarize and analyse the performance of these cases, check the operation of private bailiffs and to perform monitored control of proper calculation and determination of private bailiffs' fees.

The officials from the Inspectorate collect, compile, storage and supply different users with considerable amount of statistical information, they perform considerable amount inspection activities of the state and private enforcement.

ANALYTICAL MANAGEMENT

The necessity for implementation of "e-enforcement - Gateway to the enforcement" by the means of information system of enforcement (ISSI) is justified by the fulfilment of legal requirements and the potential effect this Gateway e-enforcement may have had.

2. CHALLENGES IN THE IMPLEMENTATION OF E-JUSTICE IN BULGARIA. NECESSITY OF A GATEWAY E-JUDICIAL EXECUTION

The implementation of the reform for the transition to e-justice could not be achieved without a clear normative rules established by the law.

There are requirements for the judiciary in terms of interfaces and how to exercise procedural rights electronically. There were introduced rules for identifying persons in the electronic environment, there rules implemented for the adoption of procedural statements of the parties conducting electronic works issuance of documents in electronic form, and other general aspects of the exercise of procedural rights of the parties and of the judicial system.

As far as technologies develop provision for a regulatory framework with which to regulate the dynamic relationship, that is not subject to permanent regulation – these formats requirements for submitting electronic documents, interface requirements for electronic submissions, requirements for the design of the public interface of the Internet pages of the judiciary and others.

The implementation of the reform in the implementation of the e-justice is impossible without the presence of certain conditions and the possibility of conducting proceedings in electronic form. In connection with these new opportunities certain rules are created to require the judiciary to use uniform rules, procedures, technology and functional parameters in ensuring opportunities for conducting proceedings in electronic form and in the course of certification statements in electronic form. Special regulations are developed for conducting proceedings in electronic form.

Pursuant to the requirements of Article 77 of the Law on private enforcement (Agents Act)¹, the obligation and responsibility of the Minister of Justice are to establish, maintain and develop the information system of enforcement (ISSI), which leads to the modern service provided by the administration and justice system. All these initiatives lead to better facilitating operational processes, improved administrative capacity for higher volume services, and promoted information security.

3. NECESSITY TO BUILD AN ELECTRONIC PORTAL ENFORCEMENT

Since the entry into force of the Law on private enforcement (2007) till present the obligation for functioning information system of enforcement is not completed. Establishing and implementing of a portal for law enforcement is essential to the Inspectorate of the Ministry of Justice on JSA.

The need for the implementation of electronic portal enforcement is justified both by the implementation of legal requirements and the potential effect it had. For reference, in 2011 in Bulgaria at the state and private enforcement there are around 650 000 enforcement cold cases (compared with district and regional courts in 2011. When there were 65,000 civil cold cases of first instance). In cases before DUI and PEA are enforceable claims for about 8.2 billion lev, without interest. For these enforcement cases Inspectorate carried out annually about 300 legal and financial checks on specific complaints and inquiries about 40 planned and thematic inspections.

Creating Portal enforcement will increase operability and transparency and will increase collections, while facilitating the work of the employees and will take much of their passive duties.

¹ Art. 77a. (New - SG. 31 of 2007) (1) The Minister of Justice shall establish, maintain and develop the information system of enforcement.

(2) Department of Justice shall charge fees for the use of the information system in an amount determined by a tariff approved by the Council of Ministers.

(3) Access to information systems through official channels to the state authorities, local government and the local administration and the persons charged with the exercise of a public function, is free.

ANALYTICAL MANAGEMENT

The main objective of ISSI is this modern service of the administration and the judiciary through: facilitating operational processes, improving the administrative capacity for higher volume services, promoting information security.

Implementation of ISSI will significantly enhance the analytical capabilities of the administration, it will facilitate management decisions, it will improve significantly the efficiency and transparency of the enforcement authorities and administration, and it will meet most of the growing interest in accessing public information and the provision of electronic services. In this sense, ISSI will reduce direct and current budgetary expenses of the administration of consumables, communication and human resources.

Through the realization of the project proposal the Ministry of Justice will also increase its own revenues by charging a tariff item 62 of № 1 to the Stamp Duty Act in relation to Article 77, paragraph 2 of the Agents Act, amounting to 100 / one hundred / BGN on user annual basis, in view of the fact that at present there is unfinished about 650 000 enforcement cases, with about 1.3 million potential users of the portal, potential revenue would be substantial. This existing legal provision will ensure financial sustainability of the project results and activities.

Enforcement portal ISSI is needed and should be built in a way that allows the participants in the enforcement process (bailiffs / JI / - public and private, creditor, debtor, creditor country as connected on the required public state receivables joined others in different qualities and supervisory bodies - the Ministry of Justice, the Chamber of private Enforcement Agents NRA PIFCA etc..) to perform certain actions according to their powers, as follows:

1. **Enforcement bailiffs** - to reflect any single act in relation to an enforcement action in ISSI, ISSI serves as a business record pursuant to § 1 paragraph 3 of the Supplementary Provisions of the Ordinance on official archives of the PEA (for PEA) and § 3, item 4, Proposal 3 of the final provisions of the Ordinance on official archives of the PEA (DIS);
2. **Creditors** - to consult on cases, to be able to perform actions after proper identification, to monitor the movement of their complaints;
3. **Debtors** - to consult on the cases, to be able to perform actions after proper identification, to monitor the movement of their complaints
4. **State** - to receive information about executive cases, to exercise the power of connected creditor on the required public receivables;
5. **Third party** counterparts in enforcement cases - to consult on the case in question, be able to perform actions after proper identification;
6. **Ministry of Justice and the Chamber of Private Enforcement**, according to their powers to be able to carry out a full inspection of an enforcement action;
7. **NRA and PIFCA** – with opportunity to perform electronic revisions;
8. **Portal** should be integrated with existing information systems and digitized databases, having attitude towards forced execution, including: The various information systems of NRA; The systems for management of court cases (CCMS); Register of private enforcement contractors; the Commercial register; the Property register; Information System insolvency proceedings (ISPN);
9. **Portal enforcement** should be integrated into the portal e-justice;
10. **The portal** should be certified according to the standards for interoperability and information security.

4. DEVELOPING INFORMATION SYSTEM OF ENFORCEMENT (ISSI). PURPOSE AND SCOPE

Requirements to ISSI: The system should cover all the quality of statistics and analytical information and security standards and confidentiality set by the Ministry of Justice and other institutions. It should provide the experts from the Inspectorate and the Ministry of Justice the opportunity to define new input and output statements and reports, calculations and processes, and outputs and publications.

ANALYTICAL MANAGEMENT

ISSI is to be implemented as a single technological environment with common functional subsystems (modules) and sub-types in accordance with Agents Act and regulations acts. This technological environment should allow for easy addition of new modules with minimal involvement of the developer.

Range: ISSI should provide to the utmost automatically all activities related to the work of bailiffs in Bulgaria. It should serve all flows of information in each phase, ensuring consistency and integrity them to follow the process of inspections and generate different types of analytical information. The system will consist of three separate modules:

- module of private enforcement;
- module of state enforcement;
- modulus of inspections;

The scope of information, provided data and services must comply with all legal requirements of the Republic of Bulgaria (JSA Agents Act, the Regulation on e-government services, etc.).

The aim here is to align and simplify the relevant procedures without substantially alter their nature and optimizing the outcome. It is expected to develop new methods for automated electronic exchange of information while ensuring the protection of the data and the inability to be subject to unlawful actions by unauthorized entities, including within the same host or store of the administration.

5. TECHNICAL SPECIFICATIONS

1. **Integration.** ISSI must provide the following:
 - Single entry of data
 - Follow-up (of the actions)
 - Unification of the client workplace
 - Systemic transparency
 - User authentication
 - High speed of information retrieval
2. **Modularity.** Heterogeneous architecture based on component technology that is used to build new applications with existing assemblies / components. Is made up of individual parts which model functionality. This allows staging in the development and implementation of the various functional parts and the ability to prioritize the implementation of tailored solutions and requirements of the client.
3. **Unification of the data.** When recording all data objects that are logically possible to use data from already established businesses with the ability to correct and complete.
4. **Distribution of functions.** The system covers all relevant institutions and organizations with the ability to include additional structures by providing functions for distributed administration of information units of the same type occurring in different units.
5. **Flexibility.** ISSI should adequately reflect environmental and internal organizational environment and to be able to react to changes in the function and structure of the entity, and to integrate new businesses, organizations and institutions.
6. **Openness.** ISSI should be integrated with popular office applications and should work on grassroots base operating software. To provide an opportunity for further development if necessary and to organize input/output to external applications and databases.
7. **Adaptability.** Input and output are ought to be parameterized, allowing them to adjust depending on the specific conditions and requirements. When displaying the information certain filters and criteria should be used by which the user would be able to sort the information.
8. **Maximum range of participants.** The system must provide automated operation with key partners and correspondents based on the use of Internet-based technologies, in combination with means for group work. The users can have strictly controlled access and

ANALYTICAL MANAGEMENT

authentication to work in real time with parts of the system detected and interpreted them with a suitable interface. Their every action to be automatically registered and their processes (input, reports, etc.) to follow standard procedures.

9. **Modern communications.** The choice of communication medium to maintain the functionality and security of job: Internet, Extranet, dial-up access.
Communication and coordination of the users of the system is achieved by means of integrated client / server communication system.
10. **Intuitive user interface.** The user interface should be intuitive for users who are not computer experts. This is especially important quality that will ensure smooth and perception in different consumer groups/units of the Ministry of Justice, DUI PEA officials in the judicial system and external users/. Users should focus their efforts towards the fulfilment of their direct functions and receive quality administrative services.
11. **Users access to all resources.** Ability to finely control access rights and action to all users objects at all levels - field (domain) server, database, records, documents and even field.
12. **Data transfer between distributed objects and main database.** Opportunity to exchange and synchronization of distributed databases without claim against the connection method. The data exchange is carried out automatically at a pre-configured hierarchy of servers, replication intervals, items and types of modifications of the bases for updates.
13. **Communication functionality.** The specifics of the information communication system functions determine the need for fast and effective communication between system users and their access to relevant information in real time. Highest standards for service activities due to their dynamic nature and require quality planning, flexible content management and rapid response to emerging events.

IP communication environment must meet the following functionalities:

- IS is **built on Client / Server and Internet / Intranet technologies to access information and databases.**

Information databases created by IP modules to be able to administer and operate over the Internet and the level of access is regulated precisely.

IS to support the core Internet protocols and provide Internet services: HTTP (Hypertext Transfer Protocol); POP3 and SMTP (Post Office Protocol Version 3 and Simple Mail Transfer Protocol); IMAP (Internet Message Access Protocol); NNTP (Network News Transfer Protocol) ; MIME (Multipurpose Internet Mail Extensions); LDAP (Lightweight Directory Access Protocol)

- **IS to be independent**

14. **Integrity.** Integrity of IP largely determined the applicability, usability, and the effects of its implementation. The heterogeneous structure of the system should be built on a single unified platform with unified development tools. This will provide full integration between modules and subsystems for effective exchange of information, centralized administration; it will generate management reports and flexible levels of access. Besides the main indicators of integration, already cited in the exhibition (single data entry, follow up, unified client workstation, system transparency and speed of information retrieval) system must meet the following criteria:

- **To be based on an open platform capable of integration with other applications and databases;**
- **To be able to interact through standard formats with other databases from external systems;**
- **To ensure performance on accepted and circulated within the administration and the judicial system platforms;**
- **To provide means of control and centralized administration;**

Integrated feature for definition and management of administrative processes, allowing any application at the time of its establishment to maintain a common definition of processes for centralized management of

ANALYTICAL MANAGEMENT

all data for a dynamic process and establishing rights of access to any information object according to the process status.

- **To provide an opportunity for connection to the System in the structures without disturbing logic functionality and security of the system.**
 - **To provide multi-platform database with an integrated communication.**
15. **Interface.** The interface of ICs must be typified to the different levels of information provision and, accordingly, to impersonate functional user groups according to the information sections to which they relate. Interface users to a system is determined by their access rights to different levels of information, which in turn is determined by the internal rules corresponding regulatory and functional structure defined by the Act. The system must provide means for flexible design of the interface, based on established data structure and its functionality. The interface should be intuitive and easy to use by the user and model as fully as possible the logic of his work.
16. **Protection information.** ISSI must protect the information on the following three levels:
- **Modules** - The protection restricts user access modules of the system, which are outside the functional prerogatives.
 - **Features** - security level functions is to implement a system of permits to modify certain data, and tools for creating, modifying and deleting of information allowing the exclusion of access to some information in dialogues and controlling the possibility / impossibility to switch to other related functions by defining level security menus.
 - **Fields** - security level fields limit the rights of a person to appear, change, or gain access to protected information by assigning control attributes of the data fields of the specified screen / dialogue. This allows information to be restricted and therefore provided only to authorized users.
17. **Information backup.** The system must use partial and full backups.
- **Partially** - The system to create archive database on a different machine that would refresh for a given period to keep the log - file of all processes relating backup, whether initiated or set to take place automatically.
 - **Complete** - system using a storage device that periodically backs up the information generated from it.

6. FUNCTIONS

1. **Access.** Access to the system to become encrypted client server channel. To allow access in hard client (encrypted access, users have the private key for authentication to the system), or through a web browser (connection via SSL and https).
2. **Users.** Identification by private key, user name and password. According to various user groups should have different rights to the system, and to be able to use different functions.
3. **Data Import** - The system allows for importing .Xls files, open integration via XML with external systems.
4. **Integration with the website of the Ministry of Justice.** The system to be able to collect, summarize and present different types of information from public enforcement, private enforcement - the system to summarizes the data on predefined parameters and make them available in different shapes /graphs, tables and so on/ to Page of MJ on the internet.
5. **Automate business processes within the Ministry of Justice /module inspections/**

The system to monitor the movement of the signals and complaints within the competence of the employees in the Inspectorate of the Ministry of Justice, JSA, each person to whom they are assigned, they should have systematic electronic signature that can be identified and recorded in the system set elements - input number, country swing of the signal and/or the appeal result, deadlines and more. In compliance with the requirements for handling personal data, the system needs to generate various

ANALYTICAL MANAGEMENT

statistical reports on preset criteria - /composition of legislation relevant entity result (recommendations, suggestions for disciplinary proceedings) and others/.

6. **Data Export** - Export data entered into the system. Xls and XML format.
7. **References** - Automatically generate reports on predetermined criteria by users. References should be integrated with Microsoft Office.
8. **Settings** - The system should provide a wide range of settings that the user can change, if necessary access rights. You do not need programming or special administration to change the settings. This should be done from a pre-built module.
9. **Search** - The system must provide full text search of information entered into the system, as well as attachments.
10. **Templates** - Enables users to create their own templates or imported ones (in. Xls file format).
11. **Nomenclatures** - Management module nomenclatures in the system - to enable all nomenclatures change.

7. CONCLUSION

The use of information technology in the judicial system improves the efficiency and transparency of the administration of justice and the goal is to continue the process of integration of information systems and ensuring their full applicability in the courts, the prosecution and investigation.

The effective functioning of the judiciary is essential to ensure free access to and exchange of information between the judiciary, public administration and civil society and business.

The introduction of many different information systems in the judicial system requires the provision of reliable connectivity between institutions and upgrading the skills of working with them.

REFERENCES

- [1] Analysis of the status and needs of electronic systems and records in the Ministry of Justice to the commitments of the Republic of Bulgaria on e-Justice (e-justice), and therefore the application of project proposals under sub-priority 3.3. "Improving service delivery by the judiciary through the development of information technology" of Operational Programme "Administrative Capacity", www.justice.government.bg/Files/doklad_minister_e-pravosadie.doc, Retrieved 2013-03-30
- [2] LJ (Judiciary Law), <http://www.lex.bg/bg/laws/ldoc/2135560660>, Retrieved 2013-03-31
- [3] Law on Private Enforcement, <http://lex.bg/laws/ldoc/2135503796>, Retrieved 2013-03-30
- [4] State Fees Act, <http://www.lex.bg/bg/laws/ldoc/2122108929>, Retrieved 2013-03-30
- [5] Ordinance on the official archive of private enforcement, <http://www.si826.com/files/reg1.pdf>, Retrieved 2013-03-30

REMARKS ON E-TOURISM IN VOIVODESHIP STRATEGIES IN POLAND



BEATA GONTAR^A

^{a)} Faculty of Management, *University of Łódź*
Department of Computer Science
ul. Matejki 22/24, *Łódź*, Poland,
e-mail: bgontar@wzmail.uni.lodz.pl, fax: +48 426355017, phone: +48 426355045

ABSTRACT

The author is interested in the development of e-tourism in Poland. One of the ways, which let compare information about regions including their policy for local development, is analysis of documents adopted and respected by each voivodeship - Strategy for Regional (Voivodeship) Development. Documents indicate the directions of development and the region priorities. They specify the main directions of future activities, in compliance with the requirements set by national policy of development and also have to respect European Commission documents. The main article's objective is to identify if there is an interest in e-tourism development, or although, e-services what can also mean e-services for tourism support, planned for realization in regional strategy development by local government.

Key words: tourism, e-tourism, ICT, development strategy, regional development

1. INTRODUCTION

Tourism is one of the fundamental aspects of policy towards its development. It is beyond doubt that tourism is an engine of economy development of the region and this development brings benefits also beyond the local dimensions. The task of local authorities is to determine the place of tourism and its development issues in developed strategies at the local level. Efficient infrastructure in areas such as transportation, public safety and accommodation, is necessary for the development of tourism activities. Increasingly important is the use of new solutions in the city, such as audio tours or tourist navigation systems. In the current programming period, the European Union supports investments related to tourism. The funds are directed to projects for the development of the hospitality and the digitization of cultural heritage. Given that the promotion of entrepreneurship in the region is in the interest of local authorities, the support of tourism sector should be one of the priorities for them. The strategy of the European Union - Europe 2020 [6], prepared by the European Commission, defines smart growth as one that supports the creation of new products and services, growth and employment of the area. In addition, the intelligent and sustainable development is one of the main objectives in the new programming period (2014-2020). The priority is to achieve better results in the creation of the information society. Sustainable development of

ANALYTICAL MANAGEMENT

the information society requires investment in ICT infrastructure, implementation of educational programs, but also developing the range of services provided by electronic means, including but not limited to e-tourist services.

The objective of this article is to present the results of the analysis done on the documents prepared by the local authorities – Voivodeship Development Strategies for each region (voivodeships) of Poland and to indicate whether it is planned to support tourism or government services by use of ICT tools.

2. TOURISM AND E-TOURISM

Tourism is one of the economy branches that generate the revenue used for accelerating the development of the city and the whole region. In 2011, Poland was visited by 13.1 million tourists, what means an increase over the previous year by 5% [4]. In next years, further growth is expected. The Travel & Tourism Competitiveness Report 2012 ranked the competitiveness of Poland's tourism sector at 49th (the score 4,4 for 7 possible) out of 139 countries. At the five first places there are countries from Europe with Switzerland as the first [9]. Each region of our country has natural beauty or cultural heritage worth of interest, which is perceived by the local authorities. Digitization of many spheres of life, the universality of the Internet, multimedia, and mobile devices are changing the look of the city, including the tourism industry. This forces a change in the way of offering travel services.

ICT plays a critical role for the competitiveness of tourism organizations and destination. E-tourism is most often associated with the purchase of travel services. ICT empowers consumers to identify, customize and purchase tourism products and supports the globalization of the industry by providing tools for developing, managing and distributing offerings worldwide. But this concept, however, is much broader and includes all the applications and devices applied in tourism, such as audio guide, mobile travel guide, electronic cards in museums, the information for tourists, information systems, virtual museums and others. The term “e-tourism” means the use of ICT technologies in all processes related to tourism. That means the tourism activities in conduct, promotion of tourist product, sale of these services, exploring and navigating travel destinations, gather information, book a flight or room [2]. The nowadays tourist is often not interested in reading the notes at the museum exhibits. He prefers to listen to the short information, or see a movie connected with them. A number of interactive museums increase and popularity of mobile audio tours prepared specially for individual tour grows, and what is very important, the tourist can often choose its language. Guiding may be accompanied by carefully selected background like: music and effects related to the historical aspect (such as the sounds of fighting, the sounds of the ancient city, etc.). This increases the availability of the object, especially for handicaps and the elder people, who move slowly. Mobile applications that are run on smartphones are more popular. Their number increasingly growing. There are augmented reality systems that link real-world image (photo taken with the phone camera) with virtual elements, which are complementary to the image of the real world with additional information elements.

3. NATIONAL DEVELOPMENT STRATEGIES

The National Development Strategy is concerned as a medium-term strategy. Its main objective is to strengthen and make use of the economic, social and institutional capabilities in order to ensure rapid and sustainable development of the country, and to improve the quality of life. The National Development Strategy 2020 (NDS) is a part of the national development management system, the foundation of which is determined by the amended law on the principles of development policy and by the document on Poland's Development Management System. Due to the need to adjust the National Development Strategy 2007-2015, to the new socio-economic conditions and to the internal and external challenges, as well as to the requirements of the introduced development policy management system, it was decided to update it and to extend its time horizon up to 2020. The efforts to update the strategy were correlated with the work

ANALYTICAL MANAGEMENT

on other strategic documents under development, such as the Long-term National Development Strategy and the Integrated Strategies.

The main strategic documents of the new system, on the basis of which the development policy is implemented, are: Long-Term National Development Strategy – LTNDS (Poland 2030 - Third Wave of Modernity) which defines major trends and challenges as well as the concept of development of the country in the long-term, Medium-Term National Development Strategy – MTNDS (National Development Strategy 2020) which is the most important document in the medium term, setting out strategic objectives for the development of the country until 2020, and key in determining the development activities, including those that can potentially be funded under the UE financial perspective 2014-2020 and under 9 Integrated Strategies whose aim is to assist in achieving the development objectives: Strategy for Innovation and Efficiency of the Economy, Human Capital Development Strategy, Transport Development Strategy, Energy Security and the Environment, Efficient State, Social Capital Development Strategy, National Strategy of Regional Development 2010-2020, Regions, cities, rural areas, Strategy for Development of the National Security System, Strategy for Sustainable Development of Rural Areas, Agriculture and Fisheries. LTNDS, MTNDS and the 9 Integrated Strategies are joined by a hierarchy of objectives and directions for intervention. The Integrated Strategies depart from a narrow sectorial approach; instead they focus on the integration of areas and on the permeability of various phenomena and processes. The National Strategy of Regional Development indicates the extent of the territorial impact of interventions implemented under various public policies, and therefore also under the remaining Integrated Strategies. It has a particular role in the whole system. It sets out the key regional development challenges and outlines the development objectives in various areas, taking into account the functions such objectives perform as well as the existing potentials and barriers.

4. REMARKS ON DEVELOPMENT STRATEGIES

The voivodeship (in article also: province, region) has been a high-level administrative subdivision of Poland since the 14th century. The Polish local government reforms adopted in 1998, which went into effect since 1st January 1999, created sixteen voivodeships. They are mostly named after historical and geographical regions. For the region, the most important is the National Strategy for Regional Development 2010-2020. The document, which sets out the policy of local authorities (provincial) is a regional development strategy, and contains the concept of purposeful and long-term development of the region. In the long term there may nevertheless be circumstances that require updating the strategies, such as the adoption of the Lisbon Strategy and the Europe 2020 strategy.

Regional development strategies are documents that try to extend the scope of the community problems of the region. They specify the main directions of future activities and possibility of region development, in compliance with the requirements set by EU institutions and documents. That is why they are more general. Their records related to e-tourism refer rather to the development of the information society and economy which leads to the creation of enterprises working for the tourism industry and use of new technologies in services. The objective of the strategy is to set priorities and directions of development in the coming years, but also an indication of the strengths and weaknesses of the region (most often in the form the SWOT analysis) and the problems that need to be taken into account in the implementation of its plans, undertaken projects and the way of their financing and estimating of their implementation.

This article reviews and analyses the strategy documents of each provinces. With each document selected comments on the assessment of tourism development were chosen (part 1) and pointed out the strategic objectives of the region, combined with the development of tourism and the use of ICT in tourism and government services (part 2). There is a summary of this analysis in Table 1.

ANALYTICAL MANAGEMENT

TABLE 1. INFORMATION ON EACH VOIVODESHIP

Voivodeship name:	Information from Voivodeship Development Strategy:
Dolnośląskie DS	<ul style="list-style-type: none"> - tourism is one of the main spheres of activity. Region well-developed with tourist infrastructure. <p>Priorities/objectives: Increasing competitiveness of the region concerning development of tourism sector, including the concentration of activities on branded touristic products Strengthen the image of the region as an attractive tourist destination</p>
Kujawsko-pomorskie KP	<ul style="list-style-type: none"> - insufficient use of nature attitudes nad cultural heritage - lack of promotion and diversification of touristic offer <p>Priorities/objectives: The development of ICT infrastructure The intergration of information systems in government, and development the database of culture heritage, accommodation</p>
Lubelskie LJ	<ul style="list-style-type: none"> - the high quality of the nature - well developed rural tourism - underdeveloped tourism infrastructure (accommodation and catering, transport and security) <p>Priorities/objectives: Supporting tourism infrastructure, the development of tourism in areas with special tourist values (eg, the Vistula River Valley, Roztocze, Polesie)</p>
Lubuskie LB	<ul style="list-style-type: none"> - interesting but not promoted values of the nature - tourism is not one of the major economy sectors - underdeveloped touristic infrastructure <p>Priorities/objectives: Dissemination of the ICT (stimulating the use of digital technologies by the administration and public services, the development and promotion of e-services such as e-government, e-health, e-tourism, digitization of public resources, creating the portal Lubuskie Gates – the objective is an access to information). Implementation of international projects, such as "Odra River for tourists 2014" and branded tourism products – like Lubusz Wine and Honey Trail.</p>
Łódzkie LD	<ul style="list-style-type: none"> - unsatisfactory state of telecommunication infrastructure and IT level <p>Priorities/objectives: Creation of telecommunication infrastructure Supporting and promotion of activities aimed at creating global information resources available in the internet Cooperation through the use of cultural and tourism attractions for the promotion of the region</p>
Małopolskie MP	<ul style="list-style-type: none"> - has a rich and unique cultural and landscape attitudes, - a large number of cultural institutions. One of the most popular regions. <p>Priorities/objectives: Heritage and natural assets should be treated as an regional element of potential opportunity, and condition of development of tourism industry</p>
Mazowieckie MA	<ul style="list-style-type: none"> - not enough trails and bicycle routs, - expansion/modernization of tourist infrastructure, - lack of information and insufficient promotion of the region <p>Priorities/goals: Development of infrastructure for the dissemination of knowledge using ICT solutions, (including the creation the Mazowiecka Digital Library) e-development of the region The creation and implementation of the infrastructure for spatial information related to such structures as: e-government, public administration.</p>
Opolskie OP	<ul style="list-style-type: none"> - lack of tourist products - poor technical condition of buildings including cultural heritage monuments <p>Priorities/objectives:</p>

ANALYTICAL MANAGEMENT

	<p>The development of e-services and ICT solutions integrating support the implementation of electronic public services, the development of information web sites such as "Opole in the Internet"</p> <p>Raising the level of competence and skills in the use of ICT techniques (learning society)</p>
Podkarpackie PK	<ul style="list-style-type: none"> - favorable geopolitical location, natural beauty, the occurrence of mineral water, a well-developed tourism. - unsatisfactory information about the region and insufficient promotion of tourism <p>Priorities/objectives: Tourism as a factor of socio-economic development of the region (Improving the competitiveness of the tourism products, the development of regional tourism)</p>
Podlaskie PD	<ul style="list-style-type: none"> - insufficient standard of tourism infrastructure - Tourist monuments and places of interest are placed far one from another - Insufficient IT infrastructure - Significant natural attitudes of the region <p>Priorities/objectives: Tourism development using natural and cultural heritage can be achieved through: a comprehensive and innovation tourist management, extending the touristic season, stimulating the development of cultural institutions and the arts, cultural promotion, recording and investigation of monuments, heritage conservation cultural heritage.</p>
Pomorskie PM	<ul style="list-style-type: none"> - unique heritage and cultural diversity of the region. <p>Priorities/objectives: To become the first tourist destination in Poland. The unique tourist and cultural offer (interesting during all year, well-known image of the region and better recognition of regional brands and cultural tourism)</p>
Śląskie SL	<ul style="list-style-type: none"> - varied and attractive tourist offer - attractive natural environment and interesting cultural heritage conducive to the development of different forms of tourism and leisure - the development of e-services and modern solutions - increasing importance of tourism as an impulse for local economy <p>Priorities/objectives: The development of skills and information society services, including e-commerce services, including: e-government, e-business, e-education, e-culture. Tourism economy is one of emerging economy items. Increasing the attractiveness of the region will contribute to the development of enterprises directly related to tourism, leisure and recreation, but also to firms and organizations working around tourism, like: catering or accommodation. (Developing of an efficient system for promoting tourist products, including an integrated network of tourist information and services, using information technology)</p>
Świętokrzyskie SW	<ul style="list-style-type: none"> - attractive tourism location (central part of the country) - rich precious mineral resources - relatively well-developed rural tourism - a small number of regional and branded tourism products, - insufficient promotion and marketing of tourism products <p>Priorities/objectives: Protection and rational use of natural resources and cultural heritage (Development of tourism infrastructure to support processes of local and regional tourism products, development of integrated system for promotion and tourist information, labelling and provision of tourist attractions) Development of systems of technical and social infrastructure, broadband internet in education, science and culture (e-business, IT systems implementation in the economy - trade, banking, travel services, etc.)</p>
Warmińsko-mazurskie WM	<ul style="list-style-type: none"> - favorable natural conditions for developing tourism and agro tourism - underdevelop tourism infrastructure - lack of concept of treatment of the environment as an advantage

ANALYTICAL MANAGEMENT

	<p>Priorities/objectives: Promotion of tourism and tourism products Maintaining a high level of information system and continuous promotion of the region Underlining the profits of being present in "web" Raising the quality of information and improving the forms of communication (including websites) Supporting the ability to use the Internet for different services</p>
Wielkopolskie WP	<p>- natural and cultural values are the tourism advantages</p> <p>Priorities/objectives: Improving the availability and consistency of communication in the region (development of infrastructure databases, and websites, educational and promotional activities, construction of e-services infrastructure) Increasing the competitiveness of the main city - Poznan (stimulating the development by integrating scientific, economic, tourism and cultural resources)</p>
Zachodniopomorskie ZP	<p>- insufficient standard of tourist accommodation and its infrastructure - insufficient promotion of the region and its attractions. - a small number of known tourist products - unused opportunities for active tourism, including rivers and lakes</p> <p>Priorities/objectives: The growing importance of the knowledge economy and e-business ventures (irrespective of the activities related to the improvement of the information infrastructure, and now also indicates the need for development of e-economy institutions (development and promotion of tourism products))</p>

Analysing the table 1, it should be noted that each region has natural or cultural potential to develop tourism and understands the importance to invest and develop this branch. Regions, which already benefit from tourism, intend to maintain their leader position by planning new investments. Voivodeships, where the services are not at satisfactory level, plan some investments in the development of tourism products and brands, expanding existing services. It especially concerns accommodation. The analysis shows that only two documents contain plans of supporting tourism by ICT tools – Lubuskie (LB) and Świętokrzyskie (SW). In next five regions, e-services (including the administration, which may be combined with the development of services in tourism) will be developed – Mazowieckie (MA), Opolskie (OP), Śląskie (SL), Wielkopolskie (WP) and Zachodniopomorskie (ZP). Although initiatives are being taken by governments of other provinces (eg. Mazowieckie - I-SPEED program [5], Małopolskie - Digital Library and Virtual Museums of Małopolskie [3]), these activities are not considered as strategic for the region and was not included in the analysed documents. Others, such as business development (including e-business), expanding telecommunication networks, increase the number of hot spots, are the result of implementation of the European Union strategy to increase the number of e-services in Poland (the government plans to implement the recommended twenty public government e-services for citizens and business eAdministration, eHealth, eEducation and others) and the State Informatization Plan for the years 2011-2015 [7].

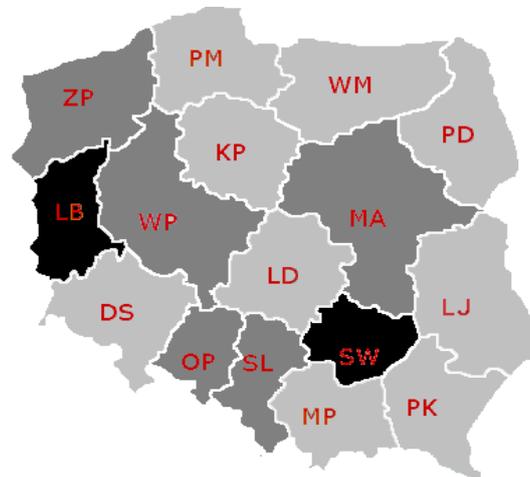


FIGURE 1. THE MAP OF POLAND WITH VOIVODESHIP INTERESTED IN E-TOURISM (BLACK) AND E-SERVICES (DARK GREY)

International research firm Synovate prepared a questionnaire about attractiveness of Polish regions and cities. 37% surveyed responded that Pomorskie voivodeship is the most attractive for tourists. Concerning the cities, Kraków (Małopolskie) is the leader - it was indicated by 60% of respondents. Gdańsk (Pomorskie) took second place in the ranking of city attractiveness with 29%, and Zakopane (Małopolskie) was the third one with 26%. According to the table 1, these two regions (Małopolskie, and Pomorskie) are not interested in investments in tourism, but it is the result of their awareness concerning their attractiveness [10].

The difficulty is also in the relatively low level of Polish preparations for the use of ICT solutions, both in terms of the lack of proper infrastructure and the willingness to use available technology. The Global Information Technology Report 2012 defines the level of maturity of each country to use ICT solutions. Ranking of countries based on the Networked Readiness Index, estimated for Poland was 3.84 and locating us in place 62 out of 138 possible (in 2011), and in 2012 Poland reached the index value as 4.16 with 49th place. For comparison, Latvia has its index equal 4.35 (place 41st) and Lithuania 4.66 (place 31st). Leading places are occupied by Sweden, Singapore, Finland and Denmark. Low rates are due to a lack of promotion of ICT in government policies and strategies, and the lack of their use in public administration. The report clearly indicates weakness of Poland in a coherent vision for the development of the ICT sector and the use of new technologies in different areas of life, including tourism. The challenge for Poland is the plan for the years 2011-2015, which aims, among others, the creation of the information society and increase the efficiency of the public administration. To take advantage of ICT first there must be developed skills of workforce.

Element, that could occur in tourism development plans is the intention or opportunity to interact with IT companies that could develop appropriate solutions for the city. Such cooperation is taken in cities that have implemented smart city concept. One of the examples is Korean Songdoli International Business District that uses a video device (Telepresence), designed by Cisco, to provide security services, education and concierge. In Rio de Janeiro IBM, Cisco and Samsung developed the system predicting floods and mud avalanches and monitoring events involving large numbers of people, sporting evacuation of spectators from the stadium or car accidents. Singapore in cooperation with IBM, introduced Electronic Road Pricing system, which calculates the amount of the fee for entry into the city area taking into consideration the level of traffic [8].

5. SUMMARY

The process of urbanization is in progress. More than a half of the world's population live in urban areas (in Poland it is about 60% of the whole population). Cities offering a variety of attractions and amenities of daily life become more and friendlier for habitants and tourist. The idea and purpose for many of them is to implement the concept of smart city. The services, which are classified as a part of the smart city, include for instance smart grids, urban integrated monitoring systems and e-government. Tourism is also an important part of this idea, exploring natural and cultural heritage of the region/city, contributing to its increasing income. Investments in the development of suitable tools for tourists can only help in the promotion of the city and whole region.

Analyzing the voivodeship development strategies and taking into account that since the publication of the Bangemann Report, we live in the information society, it can be concluded that local governments do not recognize the opportunity in the development of e-tourism. The main and common element that appears in the plans/strategies is the development of telecommunication network, which provides support to the tourists and is the potential mean for the development of e-tourism. In the analysed documents, authorities often plan promotion and development of the tourist information systems. The lack of description for more detailed solutions may be a result of a general document format, not their absence in regional policy.

Finally, it is worth to mention that some cities such as Gdańsk have prepared a development strategy up to 2030. What areas of activity should therefore be promoted to become a smart city? There were some distinguished: transport, energy, media, health, education, administration, economy, culture and the broadband infrastructure. "The city (Gdańsk) need a development strategy for culture, cuisine, entertainment, tourism, sport. Tools, which support smart city should be helpful, but it will drive people involved in the development of a common cultural identity. Therefore, all municipal investments in projects in the field of culture should include the participation of new media, the Internet, social networking sites." [1]

REFERENCES

- [1] Bendyk E., Kosieliński S., Krupis R., Rutkowski P. (2012) *Potencjał Gdańska w zakresie inteligentnego miasta*, Raport Fundacji Instytut „Mikromakro”, Gdańsk
- [2] Gontar B., Papińska-Kacperek J. (2012) E-turystyka jako element koncepcji budowania inteligentnego miasta, *Zeszyty naukowe nr 721, Studia Informatica nr 29, Szczecin*, pp.19-30
- [3] blog/muzea.malopolska.pl/o-projekcie/
- [4] <http://www.intur.com.pl/statystyka.htm>
- [5] www.ispeed.eu
- [6] www.mg.gov.pl/Bezpieczenstwo+gospodarcze/Strategia+Europa+2020
- [7] www.mssi.pl/index.php?option=com_filecabinet&task....50
- [8] www.portalsamorzadowy.pl/komunikacja-spoeczna/10-najbardziej-intelientnych-miast,43208.html
- [9] The Global Information Technology Report 210-2011, World Economic Forum 2011, pp. 23
- [10] www.wirtualmedia.pl/artykuly/krakow-i-gdansk-to-najatrakcyjniejsze-miasta-w-polsce

CONCEPTS AND METHODS OF CREATION OF LARGE SYSTEMS AND SUPPORT OF LARGE PROCESSES

R.USKENBAEVA, A. KUANDYKOV, G. BEKTEMYSOVA, B. KURMANGALIEVA

International Information Technologies University
Manasa St.34a, Almaty, Kazakhstan

e-mail: uskenbaevar@gmail.com, abu.kuandykov@gmail.com, g.bektemisova@iitu.kz, b.kurmangalieva@gmail.com

ABSTRACT

This paper describes development of concepts, methods of creation of large systems, and large processes support. Some heuristics are presented for building up large systems. Management of these heuristic recommendations and statements during creating a large system can improve the quality of the created systems and efficiency of the process of creating large systems.

Key words: government, large systems, large scale

1. METHODOLOGY DEVELOPMENT FOR LARGE SCALE SYSTEMS

Extensive use of information technology in all areas of human activity affects essentially development of the world, creates background for large scale economic and social transformations, and leads to formation of advanced society.

One of the most important components of formation of the information society is creation of “electronic government” - a system of effective interaction between government, citizens and business through services provided on the basis of information and communication technologies (ICT) [1].

Introduction of information and communication technologies (hereinafter - ICT) in public administration ensures the efficiency of government authorities (hereinafter – government authority), the transparency of public administration processes, and plays an important role in implementation of administrative reforms and improvement of the public administration system.

Currently, information and communication technologies and electronic government are introduced in Kazakhstan at a high level. The next step is improvement of public administration using ICT, which means the electronic public administration.

For introduction of the electronic public administration it is necessary to determine the general system – creation of large systems. And also, it is necessary to determine concepts, methods of creation and processes of large systems support.

Currently, there are a lot of methodologies and toolkits of creating systems. Systems created on its basis provide some performance indexes. However, it should be noted that quality performance and operational characteristics of a large scale system that based on these methods, do not always satisfy both its owners and users. Especially because it is typical for large systems that over time there are new requirements and essential changes in operational quality.

It should be noted that the large systems, which are currently being created without any methods and system standards by simplifying design, cope with its mission, carry out tasks assigned to them at a certain quality level. However, this is within subject to conditions stipulated in its design, they keep its functional performance and efficiency, but if design conditions are violated in a confined space, then they may cope with its mission.

ANALYTICAL MANAGEMENT

This is achieved by spontaneously formulated internal functional backups, which are at minimum in these systems. Functioning of these systems involves a number of problems, in particular:

Firstly, in case of violation of design conditions in a confined space, the system loses its functional qualities and efficiency;

Secondly, integration of these systems is very complex, and often is out of control.

Despite these problems, currently, among the created and operated systems the proportion of large systems increases and this tendency will be kept and/or increased. There are a lot of samples of large systems. These are social systems, government authorities systems, i.e. the system of electronic government, electronic akimats, ministries systems, and systems of the market and financial sector of economy, transport systems etc.

All this shows that the most of problems of large scale systems are caused by poorly developed infrastructures that support the process of constructing the large scale systems. Thus, construction of an infrastructure supporting the process of constructing the large scale systems is a vital task.

Development of the infrastructure should begin with development of methods of constructing large systems. Due to the fact that construction of a large system in a monolithic embodiment is not possible, therefore, we will present the large system in the form of an integrated system of combined separate systems of smaller scale. These systems are specialized, automatizing separate processes that are part of the overall automated process. All these specialized systems must be constructed on the basis of common system principles, which will ensure its full functionality and integration capacity.

Thus, the development method is based on the following principles:

- Decomposition of general process/activity into separate autonomous processes and tasks (based on Workflow-model of general process);
- Construction of each specialized system to be brought to the level of full functionality, self-sufficiency in resources with its own policy and strategy of process support (business-process);
- Ensure compatibility and integration capacity of separate system in one large system.

These systems can be created regardless of others and asynchronously. They can have different owners and resources, but, based on common principles and requirements in order to ensure its integration capacity.

Large (large scale) processes or business-processes, for automation of which there will be created the systems, vary in its features and characteristics; large business-processes are created for different purposes, and its quality are imposed many various requirements. Therefore, the method of creating a system for its support must be concretized according to individual features of the automated processes (business-processes), i.e. the method's actions must be carried out based on specific features of the automated processes (business-processes).

The instantiation is achieved through providing the method with automation rules and rules of constructing automation systems.

Thus, the method should be accompanied with rules of automation of processes of certain type and class (or business-processes). Complete rules of construction of the system include a set of rules of analysing business-processes, designing, development (based on the chosen technology of programming, construction of the system's hardware), testing, verification and validation.

Construction of the rules is carried out on the basis of experience and theoretical skills, which are formulated in the form recommendations and heuristic statements formulated on the basis of knowledge, which was accumulated on the basis of experience and theoretical generalization.

Improvement of quality of the created system and efficiency of the constructing system process allows us to use those heuristic recommendations and statements during creation of the large scale system. Let's present some heuristics for the process of constructing large systems.

Heuristics 1. During constructing a large scale system it is necessary to perform designing processes for the following purposes:

ANALYTICAL MANAGEMENT

- Designing architecture and structure of the specialized system in accordance with the designed architecture of general system;
- Designing architecture and structure of the integration system in accordance with the designed architecture of the specialized systems;
- Designing architecture and structure of the IT-Governance system in accordance with the designed functional architecture of this system.

Due to the fact that carrying out general part of the design processes to be automatic, it is necessary to generalize all methods of carrying out the design processes into a single scheme at a certain generalized level. Then, the generalized scheme of performance of the design works should be presented as “designing” micro-operations.

Macro-operations of development, verification and validation can be performed in the same way.

Heuristics 2. In order to determine the system’s architecture, it is necessary to analyse the automated processes on the basis of models of the process without system support (As-is) and (To-be).

Heuristics 3. When determining the system’s architecture, it is necessary to identify all possible options of service, and select one of them according to original design conditions, recommendations and heuristic rules for processes of creating systems.

In particular, the following options:

Let the large system service to the processes from region A and B. Here, it is possible that the business-process support, which is made in region A of all running area of the system, can be carried out in two ways: from the server, which is in region A, and from the server, which is in region B.

Here, two ways are possible:

- It can be performed by the system (i.e. the server’s software and dataware), which is in region B, and so it is possible:
- Downloading to the A region’s server of the part of B’s software and dataware, which is necessary for the business-process of region A;
- Directly from the server of B, without downloading;
- It can be performed by the system (the server, the server’s software and dataware), which is in region A.

Choosing one of the ways of service is carried out according to the volume of data flow, corrosiveness of medium, business-process’ criticality, security and risk levels.

Heuristics 4. The system (i.e. software, hardware and dataware of the system) can be centralized as the data centre, or it can be decentralized. In this connection, decentralization can be made with a variety of ways. For example, through dataware or software of the system it can be distributed among regional servers or personal work stations.

Heuristics 5. The system is completely locally-centralized, but, to deliver service to a remote area or in order to receive service from other remote systems, services of Internet or other systems can be used.

A sample of a completely centralized system is the data centre – the data processing centre.

Heuristics 6. Designing architecture of specialized and general systems should be carried out on the basis of the systems’ structures. The following ways of distributed structure of the system are possible:

- Distributed at all levels: at hardware, dataware and software levels;
- Distributed at hardware level, centralized: at software and dataware levels;
- Distributed at hardware and dataware levels, centralized at software level;
- Distributed at hardware and software levels, centralized at dataware level.

The multi-level structure and architecture of the systems provide integration of the systems at different levels.

Heuristics 7. There are two possible ways of designing the system’s functionality:

- Consistent design. At first, a work system is designed, then a cover, which provides functionality.

ANALYTICAL MANAGEMENT

- Integrated design, in which the work system and functional system are integrated.

Heuristics 8. Automation of large business-processes is characterized by identifying separate business-processes as independent ones, for the specialized systems, which provide automation of these processes, to be compatible and integrated.

Such approach is similar to the “analysis – synthesis” system approach and is natural. I.e. at first, separating – in order to solve a small scale problem, then its connection/unification – in order to solve a large scale problem.

Heuristics 9. Modelling large scale processes, in particular, government activities or activities of authorities is a very complex task. Therefore, completeness and accuracy of modelling must be as much as possible in order to accomplish the task.

Models of a large scale process or government activities are presented by combined processes, combination of which is the model of life cycle. The rule of one of the aspects of constructing architecture of government systems, based on heuristics 4 and 5, can be presented as follows.

The embassy should have its own system. This system shall be connected to the central system of the E-government. The embassies have no own system. Then the embassies shall work with the central system of the E-government.

$E\text{-government} = E\text{-centralized apparatus} + \{E\text{-embassy}_k\}, k = 1,$

$K/E\text{-state} = E\text{-government} + \{E\text{-ministry}_i\} + \{E\text{-akimat}_j\}, i = 1, m, j = 1, n.$

$E\text{-public} = \{E\text{-public organizations}_h\} + \{E\text{-international public organizations}_g\}, h=1, H; g=1, G.$

$E\text{-state} = E\text{-state} + \{E\text{-public}_i\} + \{E\text{-akimat}_j\}, i = 1, m, j = 1, n.$

Based on this method, it is necessary to establish rules of performing macro-operations for specialized and general systems: design, development, verification and validation during creation of the large process support system (activity, business-process).

REFERENCES

- [1] Overview of implementation of public services based on use of information and communication technologies in RCC. 2012
- [2] H Open Systems journal. DBMS №10, 2011.
- [3] <http://www.ega.ee/node/821>

MEASUREMENTS OF ELECTRICAL CHARGE AND ENERGY IN PSpICE SIMULATION ENVIRONMENT

A. FERIKOĞLU^A, Y. SARI^B, R. KÖKER^C AND I. PEHLIVAN^D

^{a)}Department of Electrical and Electronics Engineering, Sakarya University, 54187, Serdivan, Sakarya, Turkey
e-mail: af@sakarya.edu.tr, fax: +902642956424, phone: +902642956449

^{b)}Department of Electronics and Automation, Hendek Vocational High School, Sakarya University, 54300, Hendek, Sakarya, Turkey
e-mail: sari@sakarya.edu.tr, fax: +902646147788, phone: +902646147766

^{c)}Department of Electrical and Electronics Engineering, Sakarya University, 54187, Serdivan, Sakarya, Turkey
e-mail: rkoker@sakarya.edu.tr, fax: +902642956424, phone: +902642955900

^{d)}Department of Electrical and Electronics Engineering, Sakarya University, 54187, Serdivan, Sakarya, Turkey
e-mail: ipehlivan@sakarya.edu.tr, fax: +902642956461, phone: +902642955900

ABSTRACT

Modelling of electrical components and devices that exhibit their physical characteristics remain an attractive area of research. The models for components and devices together with operational blocks aid in the design as well as performance analysis and measurement of various circuits by allowing for detailed simulation of the circuit being tested. This paper describes application of Orcad PSpice on the measurement of such quantities as electrical charge and energy over a simulation example together with its theoretical background. The example is selected considering its educational value in that it illustrates a scientific definition of voltage and the basic law of energy conservation. Simulation results have shown that Orcad Pspice is highly easy and effective for conducting measurement simulations of electrical charge and energy as well as having a visual understanding about the underlying theory, which are valuable from the viewpoint of technical education.

Keywords: Simulation, Pspice, electrical charge.

1. INTRODUCTION

Computer simulation is a common technique for predicting the real world behaviour of a circuit. Although simulation software only reflects the capability of the model used in the back-plane and they cannot substitute the real time experimentation, they have proven educationally useful due to their easy to construct and visual properties. Orcad PSpice is a general purpose circuit simulator and one of the various versions of SPICE capable of handling analogue logical and mixed signal parts, circuits and systems [1, 2, 3]. It has been extensively used by engineers, Universities and semiconductor manufacturers as a CAD [4–15] tool because of its simplicity and effectiveness. Evaluation versions suited for educational purposes are available and can be found at the [16, 17, 18]. Many parameters of circuits and devices can be profitably simulated using these free educational versions of PSpice. In the simulation procedure different approaches may be followed, namely, electrical component level, subsystem functional block level and, higher system level comprising both of the previous ones.

This paper treats a designed and worked example of energy and charge measurement, which is fruitful from the educational standpoint. Somewhat detailed theoretical background is presented followed by an Orcad Pspice construction and analysis completed with graphics of the measured quantities, which exhibits a visual consistence with the theory. The design and simulation work are conducted in the PSpice

Orcad Capture medium, using a student version of v.9.2. Inside looks of the hierarchical blocks of models designed are also provided.

2. WORKED EXAMPLE

The example comprises the simulation of energy and charge measurement. This example also provides, as a by product, a visual verification for the standard definition of voltage. When a voltage source is involved the preferred term is electromotor force (emf): the total energy supplied to the circuit per unit charge by the source. If a passive component such as a resistor is involved the common word is potential difference (pd): the energy per unit charge converted to other energies by the component. Electrical voltage (emf or pd) is defined in units of joules per coulomb, or volts. The simulation work is performed over the exemplary circuit of Fig. 1

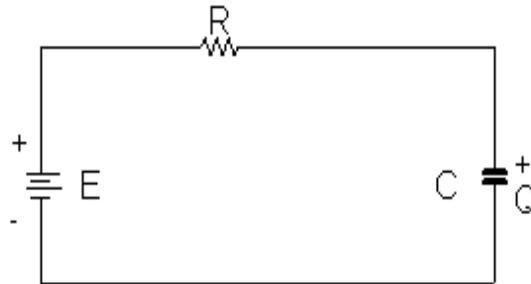


FIGURE 1. EXEMPLARY CIRCUIT OF ENERGY AND CHARGE MEASUREMENT

2.1. THEORETICAL FORMULATION

The straightforward analysis for the circuit of Fig.1 yields the instant values of capacitor voltage, current and energy functions, respectively, as,

$$V_C(t) = E(1 - e^{-t/\tau}), \quad (1)$$

$$I_C(t) = \frac{E}{R}e^{-t/\tau}, \quad (2)$$

$$W_C(t) = \frac{1}{2}E^2C(1 - 2e^{-t/\tau} + e^{-2t/\tau}), \quad (3)$$

As time goes to infinity (3) becomes,

$$W_C(\infty) = \frac{1}{2}E^2C, \quad (4)$$

Energy functions for the resistor and the source, respectively, are,

$$W_R(t) = \frac{1}{2}E^2C(1 - e^{-2t/\tau}), \quad (5)$$

$$W_S(t) = -E^2C(1 - e^{-t/\tau}), \quad (6)$$

As time goes to infinity (5) and (6) becomes,

$$W_R(\infty) = \frac{1}{2}E^2C, \quad (7)$$

$$W_S(\infty) = -E^2C, \quad (8)$$

where the minus sign in (6) and (8) indicates that the source delivers energy to the capacitor and resistor, thus satisfying as expected the conservation of energy ,

$$W_C(t) + W_R(t) + W_S(t) = 0, \quad (9)$$

The capacitor charge is given by,

$$Q_C(t) = \int I_C(t) dt = CE(1 - e^{-t/\tau}) \tag{10}$$

Now, by definition given above the source voltage is

$$\frac{-d(W_s)}{d(Q_C)} = E \tag{11}$$

since E is a constant,

$$\frac{-W_s(t)}{Q_C(t)} = E \tag{12}$$

2.2. PSPICE SIMULATION

In order to simulate an experiment for testing the given theory, an energy meter and a charge meter are designed in the Pspice medium as what follows:

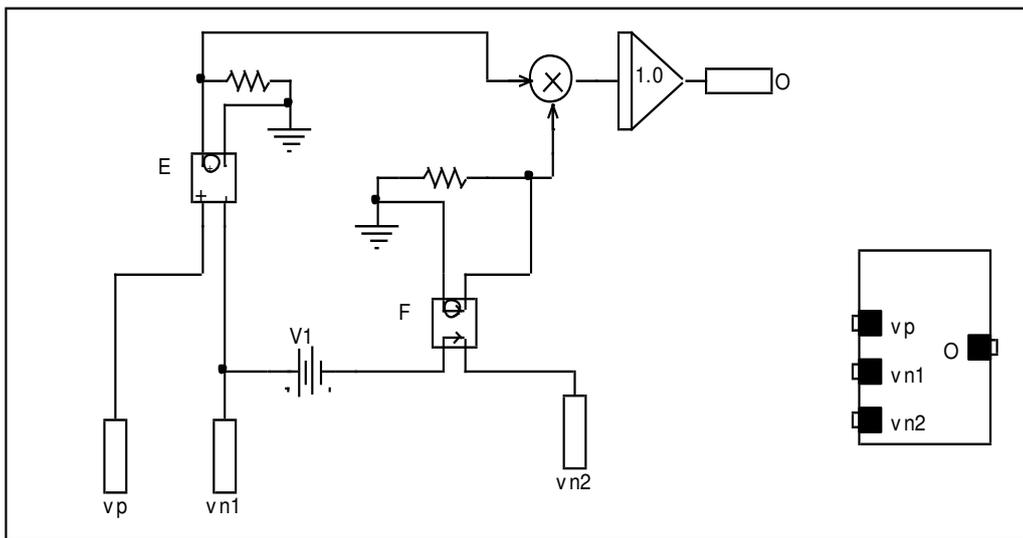


FIGURE 2. PSPICE ENERGY-METER (LEFT) AND ITS BLOCK REPRESENTATION (RIGHT) (WITH UNIT RESISTANCE AND UNIT GAIN OF VCVS AND CCCS)

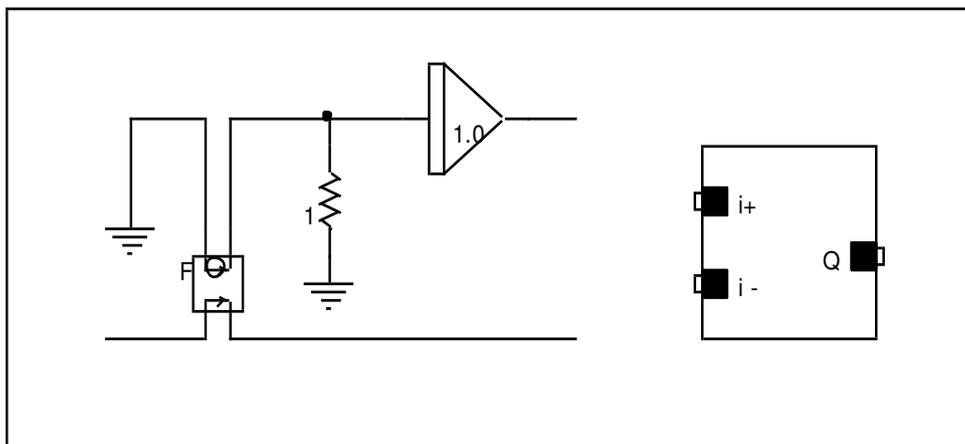


FIGURE 3. PSPICE CHARGE-METER (LEFT) AND ITS BLOCK REPRESENTATION (RIGHT) (WITH UNIT GAIN OF CCCS)

INFORMATION TECHNOLOGIES

The hierarchical blocks of meters are wired via their connection terminals to the circuit components, where numerical values, for instance, of 5V, 2Ω, and 0.6 F are assigned to the voltage source, resistor, and capacitor, respectively, as below:

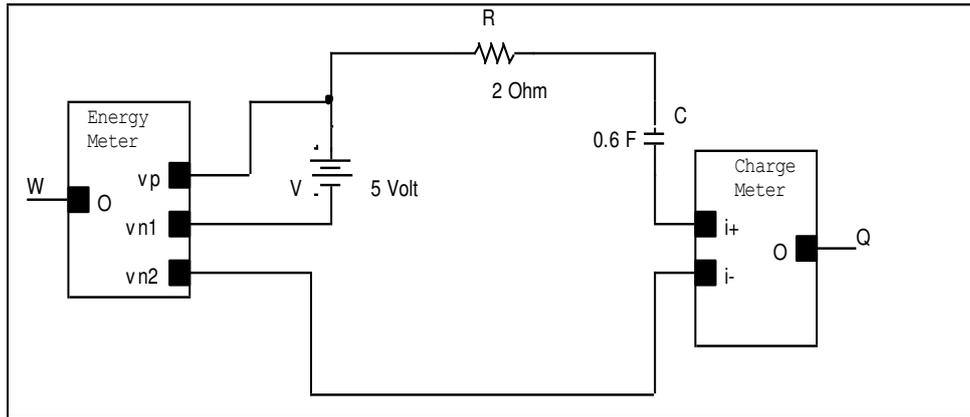


FIGURE 4. ENERGY AND CHARGE MEASUREMENT SIMULATION SETUP

The circuit Figure 4 is time analysed for 7 seconds, which is long enough to assume for the circuit to have reached its final values. The variable graphics thus obtained in Pspice Probe Window are provided below in Figure 5, together with numerical values from the output file in Table 1, which illustrates the definition of the voltage by (12).

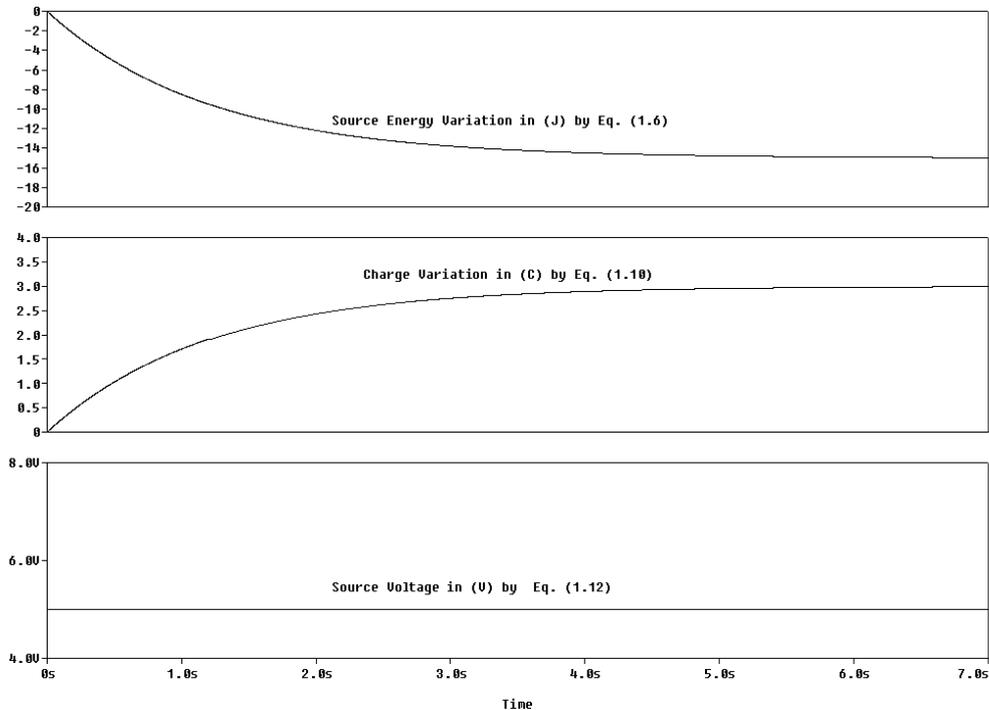


FIGURE 5. FOR THE CIRCUIT OF FIGURE 4., FROM TOP TO DOWN, SOURCE ENERGY FUNCTION GIVEN BY (6), CAPACITOR CHARGE FUNCTION GIVEN BY (10), AND SOURCE VOLTAGE GIVEN BY (11). NOTE: IN THE TOP TWO GRAPHICS VERTICAL AXIS VARIABLES ARE RENAMED IN ENERGY UNIT (J) AND CHARGE UNIT (Q), RESPECTIVELY, SINCE THE INTEGRATORS INSIDE THE METER BLOCKS WORK WITH VOLTS.

INFORMATION TECHNOLOGIES

TABLE 1. INSTANT VALUES OF THE VARIABLES OF FIGURE 5 (OBTAINED FROM THE “OUTPUT FILE” IN PSPICE MEDIUM BY TAKING DATA EVERY 0.3S)

TIME (s)	Ws (J)	Q (C)	(-Ws/Q) (V)
0.00	-0.025	0.005	5.00
0.30	-3.34	0.67	5.00
0.60	-5.92	1.18	5.00
0.90	-7.93	1.59	5.00
1.20	-9.50	1.90	5.00
1.50	-10.72	2.14	5.00
1.80	-11.67	2.33	5.00
2.10	-12.41	2.48	5.00
2.40	-12.98	2.60	5.00
2.70	-13.43	2.69	5.00
3.00	-13.78	2.76	5.00

Finally, the validity of the energy conservation law given by (9) for the example is observed, from Table 2 and Figure 7 below, after the energy meters connected across the circuit components as in Figure 6.

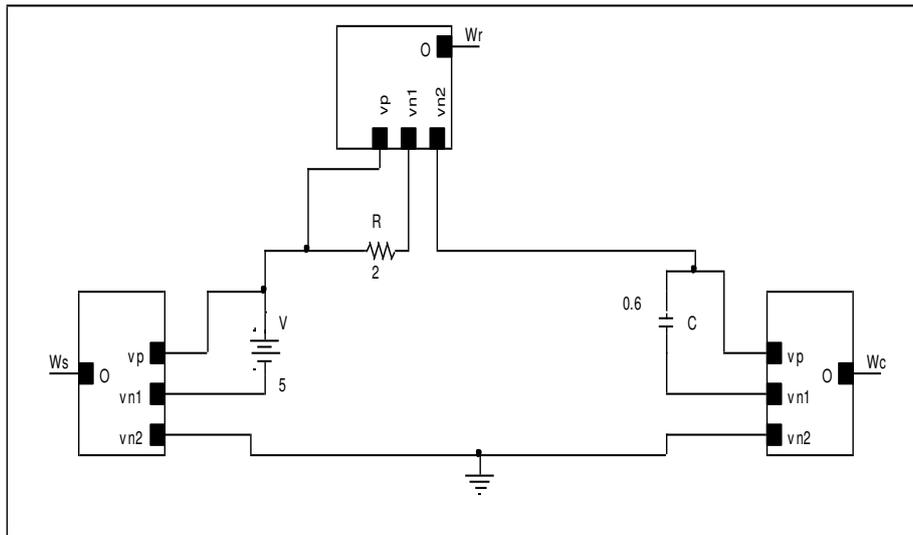


FIGURE 6. CONNECTION OF THE DESIGNED ENERGY METERS TO THE CIRCUIT COMPONENTS IN ORDER TO MEASURE THE ENERGIES OF THE COMPONENTS

TABLE 2. INSTANT VALUES OF THE VARIABLES OF FIGURE 7 (OBTAINED FROM THE “OUTPUT FILE” IN PSPICE MEDIUM BY TAKING DATA EVERY 0.3S), ILLUSTRATING NUMERICALLY THE LAW OF ENERGY CONSERVATION

TIME (s)	Wc (J)	Ws (J)	Wr (J)	ΣW (J)
0	0.00	-0.02	0.02	0.00
0.3	0.37	-3.34	2.97	0.00
0.6	1.16	-5.92	4.76	0.00
0.9	2.09	-7.93	5.84	0.00
1.2	3.00	-9.50	6.50	0.00
1.5	3.82	-10.72	6.90	0.00
1.8	4.53	-11.67	7.14	0.00
2.1	5.12	-12.41	7.29	0.00
2.4	5.61	-12.98	7.38	0.00
2.7	6.00	-13.43	7.43	0.00
3	6.32	-13.78	7.46	0.00

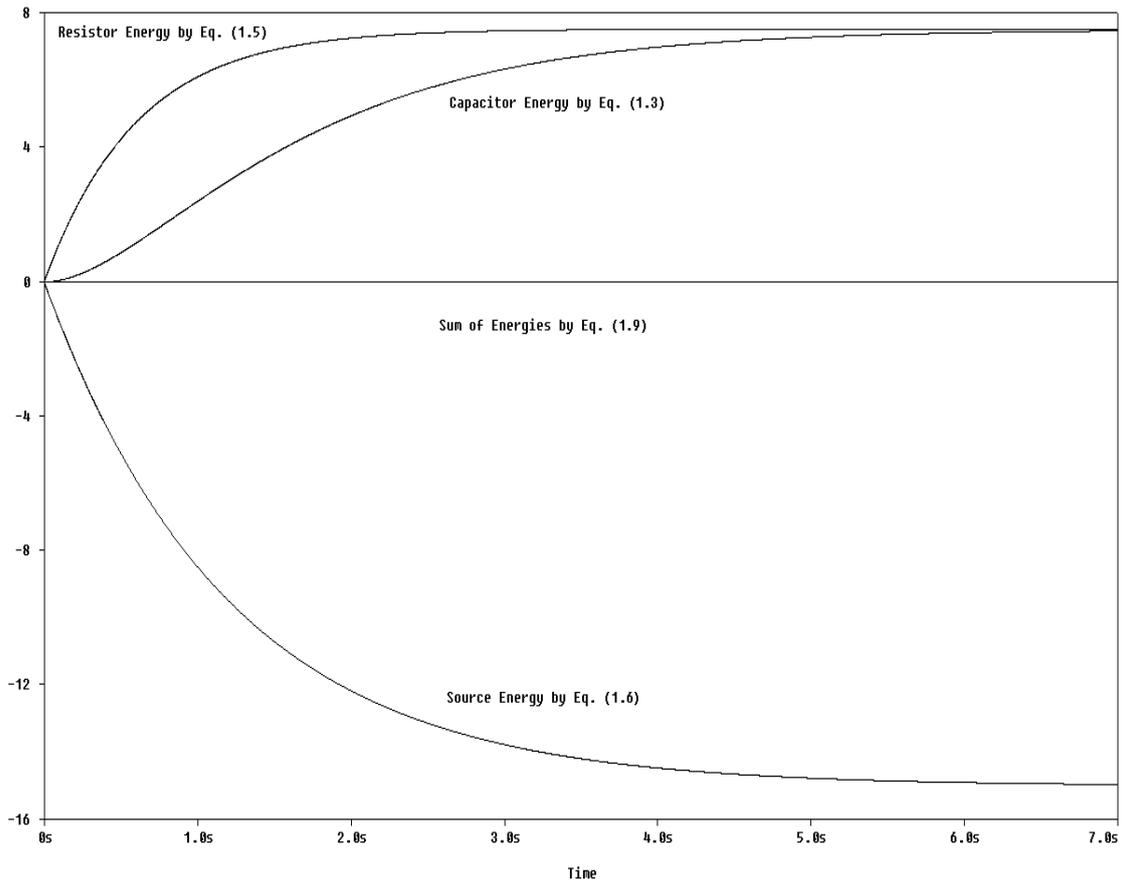


FIGURE 7. IN FIGURE 6, GRAPHICS OF THE ENERGY FUNCTIONS AND THEIR SUM, ILLUSTRATING THE LAW OF ENERGY CONSERVATION

3. CONCLUSIONS

In this study, a charge-meter and an energy meter have been designed and successfully tested in simulation medium, thus exhibiting the educational role of the powerful simulation software Orcad PSpice in Electrical Engineering. In the worked example, utilizing the new meters, the standard definition of voltage has been verified and the rule of conservation of energy has been observed.

In conclusion, the simulation results have proven to be illustrative and consistent to the theory underlying the analysis of electrical circuits and shown that Orcad PSpice, being highly visual, is very useful in the test and measurement of electrical circuits.

REFERENCES

- [1] PSpice User's manual, OrCAD Corp. (Cadence Design Systems, Inc.)
- [2] OrCAD Capture User's Guide, OrCAD Corp. (Cadence Design Systems, Inc.)
- [3] Tobin P. The Role of PSpice in the Engineering Teaching Environment, International Conference on Engineering Education-ICEE 2007
- [4] Sari Y., Ferikoğlu A. (2011) The Role of PSpice in Analog and Mixed-Signal Simulation of Electrical Circuits // 6th International Advanced Technologies Symposium (IATS'11), 16-18 May 2011, Elazığ, Turkey
- [5] Portnoy W.M. PSPICE as a Simulation Tool in Teaching Electrodynamics, fie-conference.org
- [6] Pedra J., Sainz L., Corcoles F., Lopez R., Salichs M. (2002) PSPICE Computer Model of a Nonlinear Three-

INFORMATION TECHNOLOGIES

- Phase Three-Legged Transformer // Power Engineering Review, IEEE, 22(12). – P. 64.
- [7] Koleva E., Kolev I., Balabanova I. (2009) Simulation of Optoelectronic Analog Circuits with PSPICE package // Electronics and Electrical Engineering. – Kaunas: Technologija, 8(96), P. 59–61.
 - [8] Marcinkevičius A., Jasonis V. (2003) The Aspects of Automated Design of Gigahertz Range Integrated Microchips // Electronics and Electrical Engineering. – Kaunas: Technologija, 2(44), 48-53.
 - [9] Aulas A., Dangelas V. (2001) High Power Amplifier IC for Mobile Phone // Electronics and Electrical Engineering. - Kaunas: Technologija, 5(34), 55-58.
 - [10] Pehlivan İ., Uyaroğlu Y. (2007) Rikitake Attractor and its Synchronization Application for Secure Communication Systems // Journal of Applied Sciences, 7(2), 232-236.
 - [11] Pehlivan İ., Uyaroğlu Y. (2007) Simplified Chaotic Diffusionless Lorenz Attractor and its Application to Secure Communication Systems // IET Communications, 1(5), 1015-1022.
 - [12] Uyaroglu Y, Pehlivan İ. (2010) Nonlinear Sprott94 Case A Chaotic Equation: Synchronization and Masking Communication Applications // Computers and Electrical Engineering, 36(6), 1093-1100.
 - [13] Pehlivan İ., Uyaroğlu Y., Yoğun M. (2010) Chaotic Oscillator Design and Realizations of the Rucklidge Attractor and its Synchronization and Masking Simulations // Scientific Research and Essays, 5(16), 2210-2219.
 - [14] Pehlivan İ., Uyaroglu Y. (2010) A New Chaotic attractor from General Lorenz System Family and its Electronic Experimental Implementation // Turkish Journal of Electrical Eng. Comput. Sci., 18(2), 171-184.
 - [15] Rashid M.H. (2006) Spice for Power Electronics and Electric Power. –CRC/Taylor & Francis, 552 p.
 - [16] www.ecircuitcenter.com/circuits.htm
 - [17] www.pspice.com/
 - [18] www.cadence.com/products/orcad/pages/default.aspx

MATTERS OF SATELLITE QUEUING NETWORK DESIGN IN KA-BAND FOR REPUBLIC OF KAZAKHSTAN

A.AITMAGAMBETOV, YU.BUTUZOV, S.TOREKHAN

International IT University
Department of Computer Technologies and Telecommunications
Manasa 34, 050040, Almaty, Kazakhstan
e-mail:altayzf@mail.ru

ABSTRACT

This work was carried out within the framework of research opportunities of using Ka - band satellite communication systems in the Republic of Kazakhstan. Paper deals with the multi-beam coverage in Kazakhstan (the distribution of beams in area and determine their capacity), as well as evaluation of the main parameters of subscriber channels. The need for this research was due to the fact that the design of multi-beam network for Kazakhstan is important to consider a distinct uneven distribution of the population (or potential users), low average density (about 6 persons / sq km.) and a fairly significant differences in some areas of the territory on the rain intensity.

Key words: satellite networks, Ka-Band, multi-beam antennas, bandwidth, signal-code constructions

1. GENERAL

Recent years, the accelerated development of Ka-bandas a global trend is observed in satellite communication. A considerable number of works devoted to the review of existing and planned satellite queuing systems [1-3], operating experience [4] and the results of research on the optimization of their parameters [5-7]. Before application of multi-beam technology the provision of broadband services to the mass consumer in Ka - band was considered less profitable because of the need for a super-cheap VSAT - terminals. With an advent of queuing systems, which are based on the technical application of multi-beam receiver and transmitter onboard antennas, the above mentioned problem has been solved.

The present work was carried out within the framework of research opportunities for application of Ka-band satellite communication systems in the Republic of Kazakhstan. The work is devoted to the study of multi-beam coverage in Kazakhstan (the distribution of the beams of the grounds and the determination of their capacity), as well as the evaluation of the main parameters of subscriber channels. The need for these studies is due to the fact that the design of multi-path network for Kazakhstan it is important to take into account the pronounced uneven distribution of the population (potential customers), lower average density (about 6 persons / sq km.) [8] and is quite a significant difference on the territory of the individual zones of intensity rain. The most densely populated region, where 1 sq.km for about 20 people, is the South-Kazakhstan region, and the most sparsely populated region with a minimum density of 2.3 people per 1 sq. km. km – is Aktobe region.

Levels of rainfall intensity exceeding the 0.01% of the year duration change from 10 mm / h in the western and central regions of up to 30 mm / hour in the East Kazakhstan region [9].

When choosing a geostationary satellite orbital position 58.5 E stage by stage was taken into account the fact that Kazakhstan submitted to the ITU in the Ka-band for this position 3 applications [9] (the latter KAZSAT-1R with a priority date of 11.14.2012 and was valid until 30 / 03/2018).

INFORMATION TECHNOLOGIES

Among three options forming of working area and satellite distribution capacity in the beams considered in [5, p.1] for Kazakhstan (considering the uneven population density) is set equal distribution of the beams of the grounds and the uneven distribution of capacity in the beams.

In accordance with the documents of ITU and CEPT for projected satellite network the frequency bands listed in Table 1 were selected.

TABLE 1. Frequency bands for Kazakh satellite

The transfer hub (CES)	The transfer ST
29,0 – 29,7GHz	30,0 – 30,5GHz
The receptionhub (CES)	The receptionST
18,3 – 19,0 GHz	19,2 – 19,7GHz

Note: The hub - the central earth station (gateway); ST - subscriber (user) terminal.

In Kazakhstan satellite repeater is supposed to apply separate receiving and transmitting multi-beam antennas (MBA), which will optimize the antenna maximum gain (MG), lower level of the side lobes (LSL) and reduce the cross-polarization radiation, and more precisely, sustain mutual consistency of the viewing zones at the reception and transmission. The distribution of the beams on the territory of the Republic of Kazakhstan is shown in Figure 1.

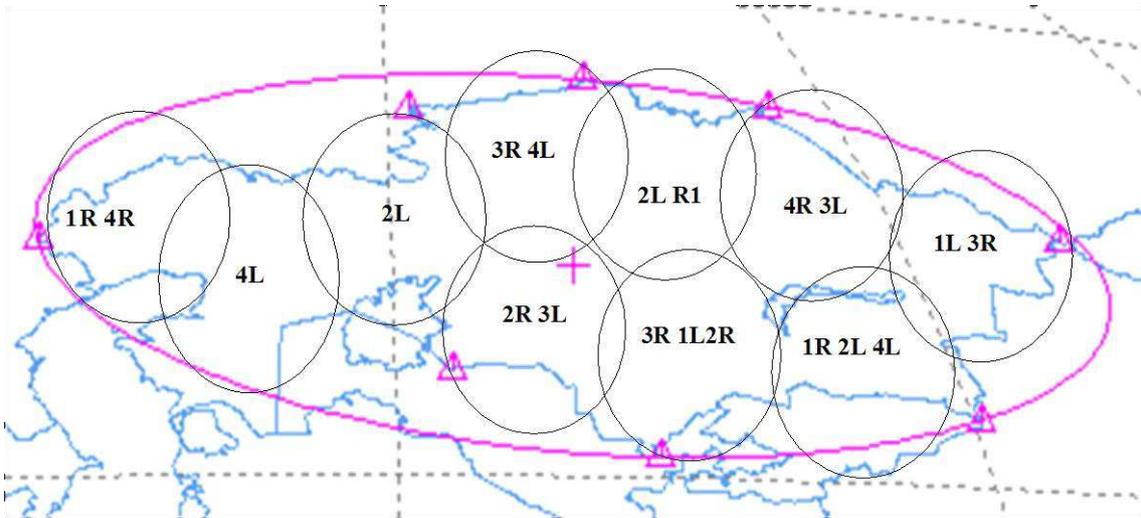


FIGURE 1. THE UNIFORM DISTRIBUTION OF BEAMS ON THE TERRITORY OF THE REPUBLIC OF KAZAKHSTAN AND THE UNEQUAL DISTRIBUTION OF CAPACITY IN THE BEAMS

Working frequency range of 500 MHz, of the band 30,0-30,5 / 19,2-19,7 GHz, is divided not by 4 but 8 liters (125 MHz each) with polarization (circular - left L and right R). The integrated frequency resource will be 2500MHz (2 beams to 1 Liter, 6 - 2 letters and 2 - to 3 letters).

To assess the throughput (C) of the forward and reverse subscriber channels their energy potentials EP and the threshold ratio of received binary symbols energy E to the power spectral density of the noise - N_o (h_p^2) were used

$$C = \frac{EP}{h_p^2} \quad (1)$$

INFORMATION TECHNOLOGIES

Let us consider the work area on the satellite uplink beams (reverse subscriber) channel. The main characteristic of the satellite transponder (ST) receiving channel is a quality factor

$$Q = \frac{G_{\text{rec}}}{T} \quad (2)$$

where $G_{\text{rec}} = 27843 / \beta^2$ [10] –is ST receiving antenna gain, $T = 1000$ K [7, p.1] –is noise temperature of the receiving path ST. The work area will be characterized by a quality factor $Q = 46,9 - 30 = 16.9$ dB / K.

As for the determination of the energy potential of the channel it is important to know the attenuation in the rain, calculations for the city of Ust-Kamenogorsk (rain intensity of 30 mm / hour) at 30 GHz for a circularly polarized radio signals in accordance with the procedure of the ITU [11] were performed. The calculation results are shown in Table 2.

Through put of reverse user channel was determined under the condition that the probability of erroneous reception of the transport stream packets is not more than 10^{-7} (ST output at 1 W bandwidth $\Delta f = 125$ MHz and the energy potential of the channel is 71.1 dBHz).

TABLE 2. 30 GHz RADIO SIGNAL ATTENUATION (CIRCULAR POLARIZATION) IN THE RAIN AT DIFFERENT PERCENTAGES OF TIME EXCEEDING

The percentage of time exceeded	Attenuation, dB
0,1	9,8
0,01	25,6

Calculations showed that in the case of input data for clear weather, and when using the SCM in standard DVB-S2 [QPSK ($m = 2$), FEC ($r = 9/10$)] reverse channel throughput will be 5.26 Mbits / sec. In this case, the required frequency resources will be 2.94 MHz. The obtained value of the throughput corresponds to about design parameters of Inmarsat-5, where the reverse link with an antenna diameter of 0.6 m is set to maximum speed of 5 Mbit/s. Table 2 shows that the loss of signal in the rain (0.1 percent of time) is 9.8 dB. In such weather conditions throughput significantly reduced (up to 550 kbit / s). The transition from rain to a new option (QPSK, $r = 1/4$) will increase this value to approximately doubled (up to 1.14 Mbit/s). Usually downloading of the reverse channel is relatively low, which makes it possible to use the reverse channel unclaimed resource for the organization of video surveillance systems [4, p.1].

Throughput offforward user channels is determined at 20 GHz, provided that the probability of erroneous reception of the transport stream packets are not more than 10^{-7} (with a satellite transponder EIRP 65.9 dBW bandwidth $\Delta f = 125$ MHz and the channel energy potential of 90.2 dBHz).

Calculations showed that in the case of input data for clear weather, and when using the SCM option for DVB-S2 standard [8-PSK ($m = 3$), FEC ($r = 9/10$)] forward subscriber channel throughput will be 224 Mbit /sec. In this case, the required frequency resource will be 83.6 MHz. Signal loss in the rain at 20 GHz (0.1 percent of time) is 5.1 dB. In such weather conditions throughput decreases to values 69.2 Mbit/s. The transition in the rain to a new option (8-PSK, $r = 3/5$) will raise the value of the throughput up to 162.2 Mbit/s. The transition in the rain on the option (QPSK, $r = 4/5$) will raise the amount of throughput up to 175 Mbit/s (with the occupied band will be approximately 110 MHz).

The total throughput of forward user channels in clear weather will be $(2 \cdot 224 + 6 \cdot 448 + 2 \cdot 672) = 4480$ Mbit/s. The specific rate determines the number of subscribers, who can be connected to the network. If to focus on the specific rate adopted for cable networks, such as 30 kbit/s, it is possible to connect approximately 149 thousand subscribers. If to provide a service similar to Wild-Blue and available in the U.S. today, it is possible to connect the 44.8 million subscribers [4, p.1].

2. CONCLUSIONS

10 beams with an angular size of $0,75^\circ$ are determined in the practice of building a multi-band satellite operating in the territory of Kazakhstan.

Energy potential of subscriber channels increases by about 10.5 dB in the transition from a single-beam to multi-beam coverage area of Kazakhstan ($\beta = 0,75^\circ$).

The results of reverse subscriber channels through put calculations have shown that by selecting the signal-code structures (parameter h_p^2) can be provided with value in the range of 5-6 Mbit/s, which corresponds, for example, the design parameters of satellites of the Inmarsat-5 [1, p. 1].

The total throughput of forward user channels is 4480 Mbit/s, which is at a specific speed of 100 kbit/s will let to connect 44.8 million subscribers to the network.

REFERENCES

- [1] Anpilogov B. (2011) Satellite queuing system in the Ka – band, Technology and Communications, Special Issue Satellite communications and broadcasting, p.16 - 21
- [2] Anpilogov B. (2011) Application to the article “Satellite queuing system in the Ka-band.” Technology and Communications, Special Issue Satellite communications and broadcasting, p. 96 - 98
- [3] Testoedov N. (2011) Plans of the Russian satellite constellation in the Ka-band frequencies. Technology and Communications, Special Issue Satellite communications and broadcasting, p. 12 - 13
- [4] Cisar L. (2011) Ka-band world experience of 2010. Technology and Communications, Special Issue Satellite communications and broadcasting, p. 50 - 52
- [5] Afonin A., Gavrilov K. (2011) Satellite Networks mass of broadband Internet access in the Ka - band: trends, analysis solutions. Bulletin of the Russian Academy of Natural Sciences, 4, p. 4 - 9
- [6] Babintsev A., Losev A. (2011) Finding the optimal parameters multi-beam satellite system. Proceedings of the NIIR, 2, p. 38 - 51
- [7] Satellite communication network: Textbook / VE Stones and dr. M. LLC "Military Parade", 2010 - 608s.
- [8] The number and density of population in Kazakhstan / Electronic resource. - Mode of access: <http://www.stat.kz/publishing/Documents/население.pdf>
- [9] Broadband satellite communications in Ka - band: a systematic approach and solutions. - Presentation of the company Astrium. - ITU Regional Workshop, Almaty, 5-7 September. 2012
- [10] Applications of the Radio Regulations, 2(2), M.: 2004
- [11] Recommendation ITU-R P.618-10 Propagation data and prediction methods required for the design of communication systems Earth - space
- [12] Electromagnetic compatibility of satellite communication systems. Ed. LY Cantor and V. Nozdrina. - Moscow: NIIR, 2009. - 280 p.

AUTHORS' INDEX

AITMAGAMBETOV A.	55
ARTEMENKOV S.	10
BEKTEMYSOVA G.	44
BUTUZOV YU.	55
DYAKON A.	5
FERIKOĞLU A.	48
GONTAR B.	36
IPALAKOVA M.T.	21
KÖKER R.	48
KUANDYKOV A.	44
KURMANGALIEVA B.	44
PEHLIVAN I.	48
PETROVA M.M.	29
SARI Y.	48
TOREKHAN S.	55
USKENBAEVA R.	44
VARBANOV S.V.	29

**Informācijas
Sistēmu
Menedžmenta
Augstskola**



**Information
Systems
Management
Institute**

***Information Technologies,
Management and Society***

2014, Volume 7, No.1

Riga, 2014

EDITORIAL BOARD:

Prof. Yuri Shunin (Chairman of the Board), *Information Systems Management Institute, Latvia;*

Prof. Victor Gopeyenko (Editor-in-Chief), *Information Systems Management Institute, Latvia;*

Prof. Igor Kabashkin, *Transport & Telecommunication Institute, Latvia;*

Prof. Kurt Schwartz, *GSI, Darmstadt, Germany;*

Prof. Martin Stanton, *Birmingham College of UK, United Kingdom;*

Prof. Arnold Kiv, *Ben-Gurion University of the Negev, Israel;*

As. Prof. Alutis Gruodis, *Vilnius University, Lithuania;*

As. Prof. Vladimir Soloviev, *Cherkassy National University, Ukraine;*

As. Prof. Victor Chlaidze, *Information Systems Management Institute, Latvia;*

Prof. Irina Kalenyuk, *Institute of Economics and Law, Ukraine;*

Technical editor: Nataly Burlutskaya, *Information Systems Management Institute, Latvia*

Host Organization:

Information Systems Management Institute, Latvia –

Roman Dyackon, ISMA President;

Marga Zhivitere, Rector

THE JOURNAL IS DESIGNED FOR PUBLISHING PAPERS CONCERNING THE FOLLOWING FIELDS OF RESEARCH:

- mathematical and computer modelling
- mathematical methods in natural and engineering sciences
- physical and technical sciences
- computer sciences and technologies
- nanotechnologies and nanodevices
- electronics and telecommunication
- logistics, telematics and transport technologies
- economics and management
- nanomanagement and nanothinking
- social sciences

Articles can be presented in journal in English. All articles are reviewed.

EDITORIAL CORRESPONDENCE

Information Systems Management Institute / Informācijas sistēmu menedžmenta augstskola
Lomonosova 1, Bld. 6, LV-1019, Riga, Latvia. Phone: (+371)-67100593. Fax: (+371)-67241591.
E-mail: isma@isma.lv, [http:// www.isma.lv](http://www.isma.lv)

Scientific and research journal of Information Systems Management Institute (Riga, Latvia)
The journal is being published since 2008.

ISSN 1691-2489
ISSN 2255-9345

Information Technologies, Management and Society. 2014,
Volume 7, No.1.

Editors Yu.N. Shunin & V.I. Gopeyenko.

Information Systems Management Institute, Riga, 2014

Copyright©isma2014

Lomonosova 1, Bld. 6, LV-1019, Riga, e-mail: isma@isma.lv, on-line: www.isma.lv

EDITORS' REMARKS

A Psalm of Life

Tell me not in mournful numbers,
Life is but an empty dream!
For the soul is dead that slumbers,
And things are not what they seem.

Life is real! Life is earnest!
And the grave is not its goal;
Dust thou art, to dust thou returnest,
Was not spoken of the soul.

Not enjoyment, and not sorrow,
Is our destined end or way;
But to act, that each tomorrow
Find us farther than today.

Art is long, and Time is fleeting,
And our hearts, though stout and brave,
Still, like muffled drums, are beating
Funeral marches to the grave.

In the world's broad field of battle,
In the bivouac of Life,
Be not like dumb, driven cattle!
Be a hero in the strife!

Trust no Future, howe'er pleasant!
Let the dead Past bury its dead!
Act, - act in the living Present!
Heart within, and God o'erhead!

Lives of great men all remind us
We can make our lives sublime,
And, departing, leave behind us
Footprints on the sand of time;

Footprints, that perhaps another,
Sailing o'er life's solemn main,
A forlorn and shipwrecked brother,
Seeing, shall take heart again.

Let us then be up and doing,
With a heart for any fate;
Still achieving, still pursuing,
Learn to labor and to wait.

Henry Wadsworth Longfellow [♥] (1807-1882)

This volume presents the selected papers of the annual International Conference Information Technologies and Management (2008, Riga, Information Systems Management Institute). These papers are divided in two basic topics of Conference, namely, Information Technologies and Analytical Management .

Editorial Board in accordance with the Journal's policy proposes the various topics for possible publications, namely, mathematical and computer modeling, mathematical methods in natural and engineering sciences, physical and technical sciences, computer sciences and technologies, nanotechnologies and nanodevices, logistics and transport technologies, economics and management, innovative education, system theory problems and system analysis

We hope our journal will be interesting for research community, and we are open for collaboration both in research and publishing. We also hope that journal's contributors will consider the collaboration with the Editorial Board as useful and constructive

EDITORS



Yu.N. Shunin



V.I. Gopeyenko

[♥] Henry Wadsworth-Longfellow was a powerful figure in the cultural life of nineteenth century America. Born in 1807, he had become a national literary figure by the 1850s and a world-famous personality by the time of his death in 1882

CONTENT

ANALYTICAL MANAGEMENT

A. DYAKON	INTEGRATED ASSESSMENT OF COMPETITIVENESS OF NATIONAL HIGHER EDUCATION SYSTEM	5
S. ARTEMENKOV	SCIENTIFIC CONCEPTIONS AND HEURISTICS IN CROSS-CULTURAL COMMUNICATION AND EDUCATION IN TERMS OF A JOINT PROBABILITY DECISION MAKING	10
M.T. IPALAKOVA	INFORMATION EXTRACTION FROM THE THEORETICAL PERSPECTIVE	21
M.M. PETROVA, S.V. VARBANOV	IMPLEMENTATION OF INFORMATION SYSTEM OF ENFORCEMENT IN BULGARIA, ACCORDING TO THE LAW ON PRIVATE ENFORCEMENT	29
B. GONTAR	REMARKS ON E-TOURISM IN VOIVODESHIP STRATEGIES IN POLAND	36
R.USKENBAEVA, A. KUANDYKOV, G. BEKTEMYSOVA, B. KURMANGALIEVA	CONCEPTS AND METHODS OF CREATION OF LARGE SYSTEMS AND SUPPORT OF LARGE PROCESSES	44

INFORMATION TECHNOLOGIES

A. FERIKOĞLU, Y. SARI, R. KÖKER, I. PEHLIVAN	MEASUREMENTS OF ELECTRICAL CHARGE AND ENERGY IN PSPICE SIMULATION ENVIRONMENT	48
A. AITMAGAMBETOV, YU. BUTUZOV, S. TOREKHAN	MATTERS OF SATELLITE QUEUING NETWORK DESIGN IN KA-BAND FOR REPUBLIC OF KAZAKHSTAN	55
	AUTHORS' INDEX	59

INTEGRATED ASSESSMENT OF COMPETITIVENESS OF NATIONAL HIGHER EDUCATION SYSTEM

ANTONINA DYAKON

Chernihiv State Institute of Economics and Management
E-mail: antonina.djakona@isma.lv

ABSTRACT

The main indicators of the national higher education system's competitiveness are analysed in the article. In the article is represented the integrated assessment of competitiveness of higher education of Ukraine to determine the basic priorities of implementation of the state policy of development of national higher education system's competitive advantages.

Keywords: national higher education system, higher education institution, integral index, estimation algorithm

1. INTRODUCTION

Statement of the problem. The higher education system is one of the main drivers of innovation development of the national economy and thus the country's competitiveness. In this regard, the need for updated and effective implementation of public policy formation of competitive advantages and development of higher education system in Ukraine based on the study of key performance indicators and parameters of activity of domestic universities over the past decades. Analytical characterization of the competitiveness of the national system of higher education, along with a statistical analysis of the main parameters of the domestic institutions of higher education provides for the implementation of integral evaluation of the influence of groups of indicators. Analysis of the level of competitiveness and the potential formation of competitive advantages of the national higher education system should be based on the principles of unity, consistency, consistency and integrity.

Analysis of recent research and publications. Various aspects of the functioning and development of the higher education system are the subject of research of many scientists, in particular: Kalenyuk I.S., Andruschenko V.P. Nikolaenko S.N., Kuklina O.V., Kholyavko N.I., Tsymbal L. I. and others. Along with this, a permanent research questions require analysis and integrated assessment of the basic parameters and trends of the national higher education system.

Statement of the problem. The aim of the article is to conduct an integrated assessment of the competitiveness of the national system of higher education to support the main directions of its development in the medium and long term.

The main material. Detailed algorithm of the integral evaluation of the competitiveness of the national system of higher education is presented in Table. 1.

TABLE 1 Detailed evaluation of the competitiveness of the algorithm

Phase 1	Feature, content phase 2
Defines the objectives and modalities of the organization - the owner of the information resources	
An information system organization, the necessary basis for the system analysis	
Organization of baseline data collection	
Formation of a group or individual performance criteria, defined as a measure for comparison of quantitative indicators in the study with respect to the operation of funds spent and the results obtained	Criterion must meet the following basic requirements: <ul style="list-style-type: none"> - Have a clear physical meaning; - Be defining and respond to the main purpose of the system, subsystem or component; - Take into account the main factors that determine the level of security of the system; - To be critical to the analysed parameters and sufficiently sensitive to them
Is given by the matrix X, in which - the value of the j-th index of the i-th object	$X = \begin{pmatrix} x_{11} & \dots & x_{1j} & \dots & x_{1n} \\ \dots & \dots & \dots & \dots & \dots \\ x_{i1} & \dots & x_{ij} & \dots & x_{in} \\ \dots & \dots & \dots & \dots & \dots \\ x_{m1} & \dots & x_{im} & \dots & x_{mn} \end{pmatrix}$ <p>The initial data in the form of a matrix allows you to explore or change the values of the</p>

ANALYTICAL MANAGEMENT

	characteristics of different objects, or values of the characteristics that describe the state of an object over time
Is given by the vector K, the elements of which reflect the importance of the j th index	$K = (k_1 \dots k_j \dots k_n)$
Is given by the vector S, whose elements take the values: • - 1, if the j th component-disincentives; • + 1, if the j th component stimulator	Stimulants - it figures corresponding to the maximum value of the best individual criteria. Disincentives - it figures that correspond to the minimum value of the best individual criteria
Standardization specifications (performance), as different characteristics may be of different dimensions. To perform the operation defined	<ul style="list-style-type: none"> - the arithmetic mean of the characteristic $X_j = \frac{1}{m} \sum_{i=1}^m X_{ij}$; - standard deviation of the jth characteristic $\sigma_j = \left[\frac{1}{m} \sum_{i=1}^m (X_{ij} - X_j)^2 \right]^{\frac{1}{2}}$; - standardized value jth object $Z_{ij} = \frac{X_{ij} - X_j}{\sigma_j}$.
Formation of a standardized matrix	$X = \begin{pmatrix} z_{11} & \dots & z_{1j} & \dots & z_{1n} \\ \dots & \dots & \dots & \dots & \dots \\ z_{i1} & \dots & z_{ij} & \dots & z_{in} \\ \dots & \dots & \dots & \dots & \dots \\ z_{m1} & \dots & z_{im} & \dots & z_{im} \end{pmatrix}$
Calculation of etalon-point	etalon-point created by the rule of characteristics - stimulants selected characteristics with maximum values, and of the characteristics - disincentives - with minimal
Ranking objects based on characteristics of the reduction	This stage has an important place in the comprehensive analysis in two cases: 1) when it is necessary to compare the state of several objects based on a uniform system of indicators; 2) The cord is not necessary to compare the results of operation of any object over time
Assessment ranking places	Determined by the distance between the points that characterize the objects under study and the reference point $P_0 : C_{i0} = \left[\sum (Z_{ik} - Z_k)^2 \right]^{\frac{1}{2}}$
The distance between the i-th element and the point can draw preliminary conclusions about the object-place ranking in the quality assessment system	- Formed vector values of the distances $C = (C_{10} C_{20} \dots C_{m0})$
	- Determined by the arithmetic mean of the distances between the i-and the object and the point $P_0 : \bar{C}_0 = \frac{1}{m} \sum_{i=1}^m C_{i0}$;
	- Calculate the standard deviation of the point $P_0 : \sigma_0 = \left[\frac{1}{m} \sum_{i=1}^m (C_{i0} - P_0)^2 \right]^{\frac{1}{2}}$
	- Quality Score is calculated functioning of the i-th object $C_0 = \bar{C}_0 + 2\sigma_0$
	You can refine the calculations, defining evaluation $D_i = 1 - \frac{C_{i0}}{C_0}$, which is interpreted as follows: the quality of the object, the higher the index value is closer to unity

Source: compiled by the author on the basis of [1; 6-7]

Consolidated integral indicator of the competitiveness of the national system of higher education can usefully be measured by the following formula: $I=0,1A+0,1B+0,15C+0,3D+0,15E+0,2F$,

And where - consolidated integral indicator of the competitiveness of the national system of higher education;

And - an integral component of intellectual and labour to ensure the competitiveness of the national system of higher education;

In - integral indicator logistics competitiveness of the national system of higher education;

C - an integral component of financial support the competitiveness of the national system of higher education;

D - an integrated indicator of the internationalization of higher education;

E - an integral component of knowledge transfer of the national system of higher education;

F - integrated performance indicator of scientific and technological activities.

Weight values of the coefficients for the calculation of the consolidated integral index of competitiveness of the national system of higher education are presented in Table. 2:

TABLE 2 Weight values of the coefficients for the determination of the consolidated integral index of competitiveness of the national higher education system

indicators	integral index of intellectual staffing competitiveness of the national system of higher education (10%)	integral component of logistics competitiveness of the national system of higher education (10%)	integral indicator of financial support competitiveness of the national system of higher education (15%)	integral indicator for knowledge transfer of the national system of higher education (30%)	integral indicator of the internationalization of the national system of higher education (15%)	integral indicator of the effectiveness of the national system of higher education (20%)
weight ratio	0,1	0,1	0,15	0,3	0,15	0,2

Source: Calculated by the author

First of all we define the integral index of intellectual - staffing competitiveness of the national higher education system. Components of the projected figure elected the following parameters: number of students, the number of trained professionals, the number of graduate students, the number of doctoral students, the number of scientists, the number of PhDs in the economy, the number of doctors in the economy, the number of specialists engaged in scientific and scientific - technical work, the number of authors of Industrial Designs.

Integral indicator of the effectiveness of the national system of higher education is based on a consideration of the dynamics of the following parameters: the volume of completed fundamental research, applied research performed by volume, the volume of completed development, the volume of completed scientific - technical services, the volume of completed scientific and scientific - technical work on the creation of new products, the volume of performed scientific and scientific - technical works on the development of materials, the volume of completed scientific and scientific - technical work on the creation of methods, theories, and the volume of completed scientific and scientific - technical works on the development of technologies.

The calculation of the above-mentioned partial indicators in order to calculate the integral composite index of competitiveness of the national higher education system requires the construction of each of these matrices observation. Matrix describes the observations to the study of the values of partial features. In the next step narrows the space in order to improve the rationality and exclusion of features does not significantly affect the productive indicator. This requires estimation of the coefficient of variation: $V_j = \frac{S_j}{\bar{x}_j}$, $S_j = \sqrt{\frac{1}{m} \sum_{i=1}^m (x_{ij} - \bar{x}_j)^2}$, $\bar{x}_j = \frac{1}{m} \sum_{i=1}^m x_{ij}$, where x_{ij} - the value of i-th index for the j-th year; \bar{x}_j - the arithmetic average value of i-th index; S_j - the standard deviation of the i-th index; V_j - coefficient of variation of the i-th index [1; 6-7].

Subsequently composed calculation table for calculating the coefficient of variation. For each j-th indicator to check the following inequality: $V_j < e$, where e - limit value [1; 6-7].

If the value of the index is less than the value of V_j $e = 0,01$, then these figures have quasiconstant and excluded from further study, and all indicators, remaining after the elimination of unnecessary and quasi are considered equivalent [1; 6-7]. The analysis showed that in this case none of the indicators is not a quasi-permanent. Features included in the observation matrix, heterogeneous, as describe various properties of objects having different units of measurement. Therefore, to be implemented prior transformation is to standardize signs. This conversion is performed in accordance with the formula: $z_{ij} = \frac{x_{ij} - \bar{x}_j}{S_j}$, where x_{ij} - values of j-th indicator for the i-th period; \bar{x}_j - the arithmetic mean of the j-th index; S_j - the standard deviation of the j-th index [1; 6-7].

Matrix of normalized indicators for each of the integral indices. When forming a point-reference (P0) of indicators stimulant elected the maximum values, and of indicators, disincentives - the minimum

ANALYTICAL MANAGEMENT

value, i.e.: $P_0(z_{01}, \dots, z_{0k}, \dots, z_{0n})$, where $z_{ok} = \max_i z_{ik}$, $k \in J$; $z_{ok} = \min_i z_{ik}$, $k \notin J$, J - Many indicators of stimulant [1; 6-7].

In the next step we calculate the integrated assessment, which is expressed in the form of the integral index. For this purpose, firstly, to determine the distance (C_{i0}) between the points characterizing the studied elements and the reference point P_0 .

Secondly, using the formulas determine the value of the integral index (I_{ni}): $I_{ni} = 1 - \frac{C_{i0}}{C_0}$,

$$C_0 = \bar{C}_0 + 2S_0, \quad \bar{C}_0 = \frac{1}{m} \sum_{i=1}^m C_{i0}, \quad S_0 = \sqrt{\frac{1}{m} \sum_{i=1}^m (C_{i0} - \bar{C}_0)^2} \quad [1; 6-7]. \quad C_{i0} = \sqrt{\sum_{k=1}^n (z_{ik} - z_{0k})^2}, \quad \text{where } i=1,2,\dots,m, k=1,2,\dots,n$$

Dynamics integral indicators ensure the competitiveness of the national higher education system is displayed in the Table. 3.

TABLE 3 Dynamics integral indicators ensure the competitiveness of the national higher education system

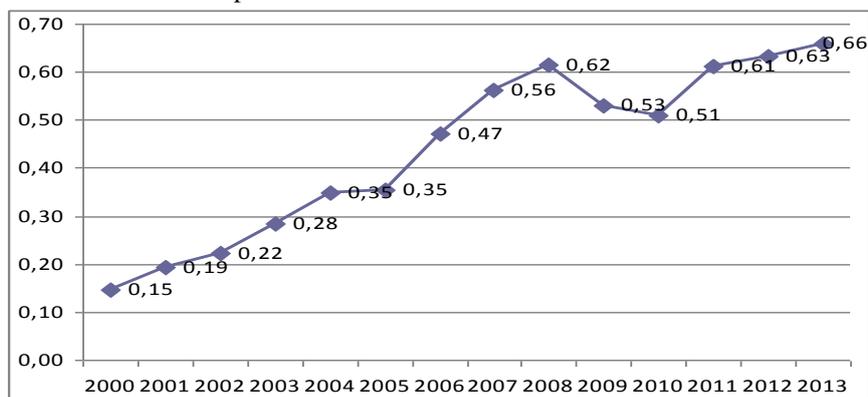
integral indicator	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Integral component intellectually - staffing competitiveness	0,12	0,18	0,17	0,26	0,28	0,38	0,44	0,48	0,55	0,56	0,55	0,52	0,36	0,23
absolute deviation (+/-) Until 2001 p.	-	0,06	0,05	0,14	0,16	0,26	0,32	0,36	0,43	0,44	0,43	0,4	0,24	0,11
The value of the integral index of the material - technical support competitiveness	0,12	0,14	0,2	0,22	0,25	0,14	0,37	0,62	0,5	0,38	0,28	0,51	0,27	0,19
absolute deviation (+/-) until 2001 p.	-	0,02	0,08	0,1	0,13	0,02	0,25	0,5	0,38	0,26	0,16	0,39	0,15	0,07
The value of the integral indicator of the competitiveness of financial security	0,18	0,26	0,32	0,37	0,43	0,45	0,49	0,52	0,6	0,66	0,63	0,81	0,82	0,8
absolute deviation (+/-) until 2001 p.	-	0,08	0,14	0,19	0,25	0,27	0,31	0,34	0,42	0,48	0,45	0,63	0,64	0,62
Value of the integral indicator for knowledge transfer of the national higher education system	0,15	0,17	0,21	0,28	0,36	0,36	0,49	0,62	0,69	0,56	0,61	0,76	0,8	0,87
absolute deviation. (+/-) To 2001 p.	-	0,02	0,06	0,13	0,21	0,21	0,34	0,47	0,54	0,41	0,46	0,61	0,65	0,72
The value of the integral indicator of the internationalization of the national higher education system	0,12	0,1	0,23	0,25	0,25	0,23	0,25	0,28	0,38	0,32	0,16	0,22	0,32	0,34
absolute deviation (+/-) until 2001 p.	-	-0,02	0,11	0,13	0,13	0,11	0,13	0,16	0,26	0,2	0,04	0,1	0,2	0,22
The value of the performance indicator of the national higher education system	0,16	0,27	0,21	0,3	0,44	0,46	0,66	0,73	0,78	0,61	0,62	0,64	0,83	0,87
absolute deviation (+/-) until 2001 p.	-	0,11	0,05	0,14	0,28	0,3	0,5	0,57	0,62	0,45	0,46	0,48	0,67	0,71

Source: Calculated by the author

Thus, on the basis of the obtained results it can be stated quite strong intellectual potential - human factors in ensuring the competitiveness of the national system of higher education. Along with this, the problems of aging are updated scientific - teaching staff, the outflow of talented scientists abroad, and low interest young people in science - research activity owing to the relatively low wages. The calculations of the integral index material -Technical ensure the competitiveness of the national higher education system suggest the existence of a number of problems in domestic universities in terms of obsolete and non-operational equipment upgrades needed to provide educational and scientific processes. Particularly urgent is the problem of delayed introduction of modern information - communication technology in universities.

As follows from the results of the simulations performed by the integral indicator of internationalization of higher education, a significant public attention require the intensification factors representation of national universities in the global educational and scientific community. Improving the competitiveness of Ukrainian universities in the educational market is increasing the flow of students (including foreign). Based on a comprehensive generalization of the study is to develop a well-founded

consolidated integral indicator of the competitiveness of the national higher education system, the dynamics of which is reflected in pic. 1.



Picture 1 Dynamics of composite integral index of competitiveness of the national higher education system
Source: constructed by the author.

2. CONCLUSION

Thus, we can conclude that there is a positive trend in the composite performance indicator of the national system of higher education. Along with this, it is necessary to focus attention on the fact that the impact of higher education institutions directly determines the level of their competitiveness. Given the powerful intellectual and human resource capacity of the higher education of Ukraine, in our opinion, the impact of factors can be identified as one of the key factors in strengthening the competitiveness of the national system of higher education at the national level.

Integral assessment of the competitiveness of the national higher education system proves the existence of the Ukrainian universities powerful intellectual and human resource capacity, completion of which determines the effectiveness of the implementation of activities to improve their competitiveness. Problems of development of the system of higher education in Ukraine is concentrated mainly in the parameters of logistical and financial support of teaching methods, research, innovation, international activities of educational institutions. Priority by the management of universities and government regulation of higher education requires activation of factors associated with the transfer of knowledge, efficiency and internationalization of the universities.

REFERENCES

- [1] Антохонова И. В. (2004) *Методы прогнозирования социально-экономических процессов* / И.В. Антохонова. – Улан-Удэ: Ид-во ВСГТУ, 212 с
- [2] Каленюк І. (2002) *Проблеми та механізми фінансового регулювання освіти в сучасних умовах* // Вища освіта. **4-5**, С. 82-90
- [3] Каленюк І.С. (2011) *Інтеграція вищої освіти України в європейський та світовий освітній простір: економічний вимір: монографія* / І.С. Каленюк, О.І. Гонга, М.П. Вербовий, Н.І. Холявко; За заг. ред. д.е.н., проф. Каленюк І.С. – Чернігів: РВК «Десяняська правда» 165 с.
- [4] Каленюк І.С. (2014) *Освітній імператив суспільного розвитку: Наукова монографія* / І.С. Каленюк, О.І. Гонга, Холявко Н.І., Сакун О.С., Демченко О.П., Дьякон А.А., Цимбал Л.І. За заг. ред. д.е.н., проф. І.С.Каленюк. – Чернігів: ЧДДЕУ, 172 с.
- [5] Каленюк І.С. (2012) *Розвиток вищої освіти та економіка знань: монографія*/ І.С. Каленюк, О.В. Куклін. – К.: Знання, 343 с. – (Сучасна наука)
- [6] Носко В. П. (2011) *Економетрика: учебн.* / В.П. Носко. – М.: Издательский дом «Дело», 576 с
- [7] Скітер І. С. (2009) *Аналіз економетричних підходів в моделюванні інноваційних процесів* / І. С. Скітер, Л. С. Ладонько // Держава та регіони. Серія: Економіка та підприємництво. – Запоріжжя : Клас. прив. ун-т, **1**, С. 200–204.

SCIENTIFIC CONCEPTIONS AND HEURISTICS IN CROSS-CULTURAL COMMUNICATION AND EDUCATION IN TERMS OF A JOINT PROBABILITY DECISION MAKING



S. ARTEMENKOV

Moscow State University of Psychology and Education
Department of Information Technologies
Sretenka 29, 127051, Moscow, Russia,
e-mail: slart@inbox.ru, phone+ 7926 2071465

ABSTRACT

In contemporary cross-cultural communication and education processes the human decision making and heuristics are often mistakenly evaluated by means of a certain standard scientific conceptions. For example the tendency to consider human estimations of joint probability as the Conjunction Fallacy may be regarded as a form of scientific illusion. The transcendental psychology approach to perception makes it possible to substantiate co-representation probability models which are compliant with human perceptual psychology and heuristic judgment under uncertainty. Presented pilot cross-cultural experiment provides for possibility to influence a person's decision making process in predicted direction varying perceptual and semantic situational parameters according to theoretical assumptions connected with co-representation model of events.

Key words: Scientific Conception, Heuristic, Transcendental Psychology, Perception, Co-representation, Probability, Conjunction Fallacy, Illusions, Cross-cultural Experiment.

1. INTRODUCTION

In the present-day world scientific conceptions play an important role in social and vital activity of the people. Scientific knowledge and models are of great value in cross-cultural communication and international educational standards. They actually often objectify universal cross-cultural truth, which make it possible to create explanatory models, integrate social medium, predict phenomena and results of experiments, produce comparative studies and so forth.

Norm anchoring as general scientific method lies in objective norm determination and their correlation with phenomena under consideration. In particular this is done in psychological diagnostics, where individual qualities are compared to normative sample. Most tests used in psychological practice are norm-referenced, i.e. the subject's test scores are judged against typical test scores from a representative group of individuals (norms). This involves the application of the test to an appropriate group of subjects and the construction of normative data. The process of setting up normative data is called test standardization.

ANALYTICAL MANAGEMENT

It's possible to state that in mathematics normative knowledge is manifested in most general form. Mathematical knowledge has universal character and often may be implemented in various sciences and fields of practice. Especially it is widely used in education. In this connection mathematical models in an even greater extent become normative. For example the model of probability of joint random events (or joint probability model) is often used for calculation of accidental chances and as a matter of fact has become a norm for evaluation different causal occasions, which have one or another uncertainty of their appearance. Joint probability model is widely used in contemporary education and is regarded as universal explanatory mean in educational attainment of very different cultures. It is known also that education is rather conservative element in different cultures and keeps many rules and norms for a long time. So revealing and understanding of these conservative things is a matter of topical interest.

At the same time on the whole heuristic decision making in differently presented real circumstances disagree with probability theory model [8]. Therefore it is reasonable to count that this model should not be used as unconditionally normative model for evaluation of human behaviour in uncertainty conditions. More than that - we argue against common set that this model is suitable for evaluation of human decision making.

Thus we would like to show the limits of a joint probability model's application as a normative cross-cultural model using as basis theoretical provisions of cross-cultural communication [6] and platform of transcendental psychology [5]. The last approach presents a general foundation for critique of a product basis paradigm and for development of a novel constrictive methodological paradigm. We consider psychologically valid mathematical model of joint probability of co-represented events and carry out pilot cross-cultural study of estimated probability of accidental events in the circumstances of predisposition to interpretation these events within the model of co-represented events.

2. HEURISTICS AND SCIENTIFIC DISCOURSE

Subsequent to the investigations of Tversky and Kahneman it is well known that judgments under uncertainty are often mediated by intuitive heuristics [12, 13]. Heuristics as intuitive judgments occupy a position between the automatic operations of perception and the deliberate operations of reasoning. So they deal with the concepts as well as with the precepts, can be evoked by language and are not bound by specific scientific natural laws.

According to prevailing explanation when people rely on representativeness or availability to make judgments, they are likely to judge wrongly because the fact that something is more representative does not make it more likely. Thus it can result in neglect of relevant base rates based mainly on standard probability models (as for example coin tossing or throw of dice). Instances of a specific category can be easier to imagine or to retrieve than instances of a more inclusive category. Conjunction can be more representative than one of its constituents.

The so called representativeness and availability heuristics [13] therefore can make a conjunction appear more probable than one of its constituents, which breaks the most basic qualitative law of probability – the Conjunction Rule: The probability of a conjunction, $P(A\&B)$, cannot exceed the probabilities of its constituents, $P(A)$ and $P(B)$, because the extension (or the possibility set) of the conjunction is included in the extension of its constituents.

Thus so called "Conjunction Fallacy" is false belief that two events have greater chance of co-occurring than either event by itself. This phenomenon was regarded as cognitive illusion and demonstrated in a variety of contexts including estimation of word frequency, personality judgment, medical prognosis, decision under risk, suspicion of criminal acts, and political forecasting [8].

In the well-known Bank Teller Study [13] subject receives description of the following situation.

Linda is 31 years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in anti-nuclear demonstrations. The question is: Which of the following alternatives is more probable?

A) Linda is a bank teller.

B) Linda is a bank teller and active in the feminist movement.

ANALYTICAL MANAGEMENT

Most participants picked – B and have fallen prey to the Conjunction Fallacy. It is not possible for two events to be more probable than one of the events by itself.

As it was mentioned previously [4] the systematic character of violations of the conjunction rule makes it absolutely unclear - why such inadequate behaviour takes place and occur so often? The common answer to this question is contrasting heuristics and intuitive inferences to specific mental logical operations and specific scientific gains as the rules of statistics and the laws of probability. These laws are then used as objective measure of the perceptual and cognitive processes. Fallibility of this approach was studied in our work [4]. The error here is common to the positivist way of thinking when scientists make abstract truth more concrete or real reifying it as a law of objective reality and then anchoring to it concrete events or phenomena. For example, when “culture” is described in positivist ways, it is reified or essentialized [6].

Following this line it is possible to state that opposition of scientific discourse and heuristics is not right neither from the point of view of their difference as being similar, nor - of their similarity in being various. The opposition as such emerges when researchers fix the different results of two psychological processes within equal environmental conditions. On closer examination it is possible to notice that context situations for logical mental and perceptual intuitive operations are different and these psychic processes have very distinct nature. Thus simple comparative judgment model is hardly applicable in this case.

Behaviour according to scientific model may be more or less easily achieved as a result of special education, while on the whole this is not the same for heuristics. Science itself relies on numerous intuitive grounds and heuristic operations (discrimination, identification, association and so on). It is also known that being distinct from the scientific discourse heuristics are existed since the beginning of time and people relied on them long before scientific laws have been discovered. Depending upon intuitive judgments, often presented in the form of specific legends and myths, people during a long road of their historic development have been in many ways quite successful in their life activity both in relations to nature and interrelationship.

On the basis of myths’ analysis clinical psychologist J. Peterson concluded that “the only alternative to presuming that everyone unfortunate enough to live prior to the dawn of the scientific age was pathetically ignorant, despite their incontrovertible success at surviving”, is to suppose that “objective world is something that has been conjured up for us recently – absurdly recently, from the perspective of evolutionary biology” and “the environment of human beings might well be regarded as “spiritual,” as well as “material” [10].

Methodologically this way of thinking comes from constructive approach in sociology [14], which assumes the fact that “observer interacts with reality via his or her perspective in such a way that reality is organized according to the perspective”. In culture theory “the constructivist paradigm avoids the reification of culture, either in its objective sense of the institutions or in its subjective sense of worldview”. “People ... are constantly in the process of interacting with the world in ways that both express the pattern of the history of their interactions and that contribute to those patterns” [6].

Special constructive approach in psychology of perception was developed by A.I. Mirakyan (1929-1995) and his group at the Psychological Institute of the Russian Academy of Education. It was called the transcendental psychology approach and implies special methodology [5]. It was developed to overcome crucial limitations and contradictions inherent in traditional approaches to perception and is strongly methodologically correlated with embodied cognition and enactive approach [2, 3] and understanding of psychic activities as “an ability to strongly feel in mind” (kansei) [4].

Transcendental psychology methodology focuses upon the underlying transcendental processes and upon the principles that support the flexibility needed to create complex, coherent representations under different stimulus conditions. The central idea, that the generative perceptual processes are different from emergent psychological processes dealing with perceptual images and may be based on universal formation of relations, suggested basic principles that can be applied to all perceptual processes, regardless of their modality [5].

ANALYTICAL MANAGEMENT

The constructive approach makes it possible to see that scientific norms used for evaluation of human behaviour are not impeccable and when real human reasoning or performance and normative competence (rational computation) diverge, more often there is something wrong with the norms, not with the reasoning [4]. In regard to conjunction fallacy it is not of course the case that probability theory is wrong. Rather human behaviour is more complex and the model used for its evaluation is too rigid. The transcendental psychology approach makes it possible to substantiate other probability models which are compliant with the human judgment under uncertainty.

Contemporary cross-cultural studies of geography of thought specific to different people of the world obviously show that the scientific form of thinking has gone through long way of development and scientific norms are not ubiquitous and equally intrinsic to different ethnic groups of people. More than that specific scientific conceptions are not uniquely true and their application is often connected with natural, cultural-historic, socioeconomic and other peculiarities of evolution and education conditions of various nations [9].

3. CO-REPRESENTATION PRINCIPLE IN PERCEPTION AND MATHEMATICAL MODEL OF JOINT PROBABILITY EVENTS

The transcendental psychology of perception states that perceptual processes include co-existence of different alternatives providing the flexibility needed by any multifunctional perceptual and cognitive system [5]. This assumes that the nature of perceptual cognition is more complex and quite different from common probability logic. According to the perceptual reality for any object it is more reliable to have many defined and related features than just one feature. Thus perceptual processes (unlike thinking processes) display that the object with many simultaneous features belonging to it is in fact more valid and actual than abstract object with just a few abstract or random features.

The co-representation principle in perception means that images and their characteristics are the products of underlying formation of relations and the work of multiple mutual (unconscious and conscious) tendencies. So image features are all connected and united within the process of their creation and have all the time connection to the person to whom they are presented.

Thus the appropriate simple probability model suitable for explanation of human behaviour under uncertainty should be done with a glance of co-representation idea. Instead of taking a probability model connected with tossing a coin or throwing lots we suggest for instance the usage of a locket. Let us consider a tossing of the locket, which can be opened, holds nothing and imitates a coin outside. It gives 4 incompatible states (A -head, B-tail, A&B, Nothing) with possible roughly equal chances (Figure 1). It is easy to see that in this model conjunction event of opened locket has equal chances with any of separate locket coin states: $P(A) = P(B) = P(A\&B)$. Here P is probability of the events in parentheses.



FIGURE 1. THE EXAMPLE OF A LOCKET IN FOUR STATES

It is clear that calculation of chances depends on a whole space of elementary events as well as on favourable set of events. They are in their turn determined by logical and other operations which are often implicitly feasible on the sets. If we consider also the logical conjunction (A&B) and disjunction (A∨B) operations on A and B events, then probability of just one event A or B is still equals $\frac{1}{4}$ and

ANALYTICAL MANAGEMENT

probability of two A and B events may correspond to $A \vee B$ situation and so will be equal $\frac{3}{4}$. That is 3 times higher than $P(A)$. The disjunction of A and B events corresponds to perceptual reality of objects in the sense that if two features are thing specific then each of them are also specific to this object. More over in other case the existence of just one A or B event will be in principle impossible.

Thus in psychological perceptual model of events' probability perfectly reasonable is to suppose that A and B events are more probable than separate A or B events. In the standard probability model we deal with separate random events while in presented psychological model the events have common origin or common representation medium.

The two models serve very different spheres of reality. The standard model comes from the lack of knowledge about objective situation, while psychological perceptual model presuppose a certain understanding of the situation starting from the self of a person. Tossing of a coin then assumes that only one possibility of two (head and tail) is possible each time while we know that two sides are simultaneously presented on a coin. To consider the chances of A and A&B events in this case is not correct. These events do not belong to the same set of elementary events.

As we see here the knowledge about A and B events include multiple meaning and the number of events connected with logical operations may be increased too. We have both ambiguity of conjunction and disjunction operations and multiple events in disjunction operation. This results in expansion of the number of favourable events for A and B association and so provides in this case for higher estimation of chances.

It may be noted that this ambiguity is not specific just for psychological situation and is observed in quantum physics, where it leads to difficulties in quantum measurements. Researchers need to "take into account that the general physical operational situation for two measurements is the situation where they cannot necessarily be carried out at once (or together), which in quantum jargon means that they are incompatible". "In this case, the conjunction for these properties, of which one is measured by one of the measurements and the other by the other measurement, still exists as an operational property, but the disjunction does not necessarily exists as an operational property" [1].

More complex model of throwing the rhombicuboctahedron die may be even more demonstrative in regard to the rate of conjunction probability (Figure 2). The rhombicuboctahedron is an Archimedean solid with eight triangular and eighteen square faces. There are 24 identical vertices, with one triangle and three squares meeting at each. The rhombicuboctahedron can be seen as an expanded cube (or an expanded octahedron) and as such includes six square sides of an original cube from which it is generated.

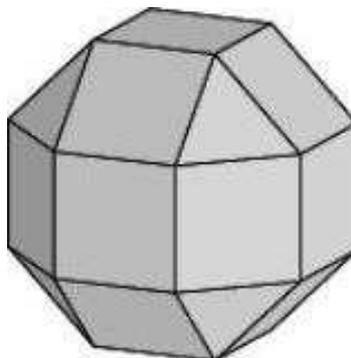


FIGURE 2. RHOMBICUBOCTAHEDRON

In throwing the rhombicuboctahedron die the chances to see from one direction a certain A&B combination of two facets originated from primary cubic die are in general three times higher than chances to receive just one facet of this die.

ANALYTICAL MANAGEMENT

If probability $P(\text{any side}) = 1/26$, then $P(A\&B) = 3/26$. So in this case $P(A\&B) > P(A)$. In principle the fall on the triangle side (probability P_3) may be less possible than the fall on the square side (probability P_4). Putting $P_3 = 3 \cdot P_4/4$ it is possible to calculate that $P_4(A\&B) = 2,5 \cdot P_4(A)$.

These modelling results clearly shows that $P(A\&B) > P(A)$ and they agree with human decisions made in numerous experiments [8] and with results shown in our work [4].

4. CROSS-CULTURAL EXPERIMENT

Strongly mathematical co-representation probability model, which is examined above, is suitable for explanation of human joint probability decision making and agree with human psychology of perception. To understand how it is working in reality we carried out pilot cross-cultural psychological research for joint probability judgments of co-represented events. According to the developed model we worked out special logical inventory for measuring probability of hypothetical events which can occur simultaneously and have different basic rates. The tasks were made similar to Linda Bank Teller Study shown above.

Herewith the number of choices was increased with the need to compare chances (more less or equal) of A and A&B together with two more variants: A and B, B and A&B. Situations in three different tasks were organized in a way that the chance levels (rarity) of A and B events were done either approximately equal or not equal: task 1 - $P(A) < P(B)$; task 2 - $P(A) > P(B)$; task 3 - $P(A)$ and $P(B)$ are together small. The chance level of co-existence of events was decreased from task to task. This was done with the aim to check how co-representation influences decision preferences of the subjects. Comparison objectives in each task included the following decisions: $P(A)$ as compared to $P(B)$ – more, less or equal; $P(A\&B)$ as compared to $P(A)$ and to $P(B)$ - more, less or equal.

The sample of observations included 20 Moscow students and 10 subjects from Taiwan. The engagement of two cultures had the purpose to receive more variants of subjects’ behaviour in hypothetical uncertainty conditions and to reveal cross-cultural similarities and differences in evaluation of events’ rates.

The diagrams with experimental results are shown on Figure 3 and Figure 4 for Russian and Taiwanese subjects correspondently. The columns show relative frequencies in percentages for A and B events in regard to the compliance and violation of the Conjunction Rule for Russian and Taiwanese subjects.

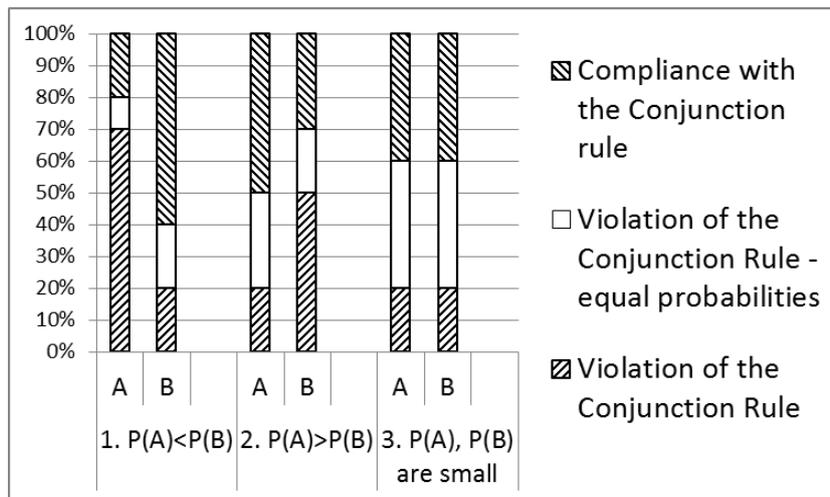


FIGURE 3. PERCENTAGE OF DIFFERENT TYPES OF ANSWERS SHOWING COMPLIANCE AND VIOLATION OF THE CONJUNCTION RULE - $P(A\&B)$ AS COMPARED TO $P(A)$ OR $P(B)$ - DEPENDING ON TASK SITUATIONS FOR RUSSIAN SUBJECTS.

ANALYTICAL MANAGEMENT

The Russian subjects better than the Taiwanese differentiate the rates of A and B events in the situation of task 1. So B event is regarded in Russia much more probable. Therefore the probability of conjunction of events A&B in Russia is more strongly differently estimated for A and B events.

In the situation of task 2 when $P(A) > P(B)$ and coexistence of events in principle is less possible the zone of violation of the Conjunction Rule with equal probabilities of two and single events is much broader. Cultural differences specify that Russian subjects better discriminate probabilities of single A and B events.

Characteristic is task 3 situation when both A and B events are unlikely. Here the conjunction of these events is also hardly probable. In this situation the Russian subjects show no difference between A and B objectives at all while the Taiwanese – show very little difference and in both cases the percentage of answers compliant with the Conjunction Rule is more than twice higher than that of violation of the Conjunction Rule.

The diagrams on Figure 5 shows relative percentages of answers' preferences for one (A or B) and two (A&B) events depending on task situations for Russia and Taiwan. In both countries in accordance with theoretical background the portion of subjects having preferences for two events is less for the third task than for the first task. The Taiwanese subjects are more oriented towards one event preference and so are more unyielding to the Conjunction Fallacy (rarely violate the Conjunction Rule).

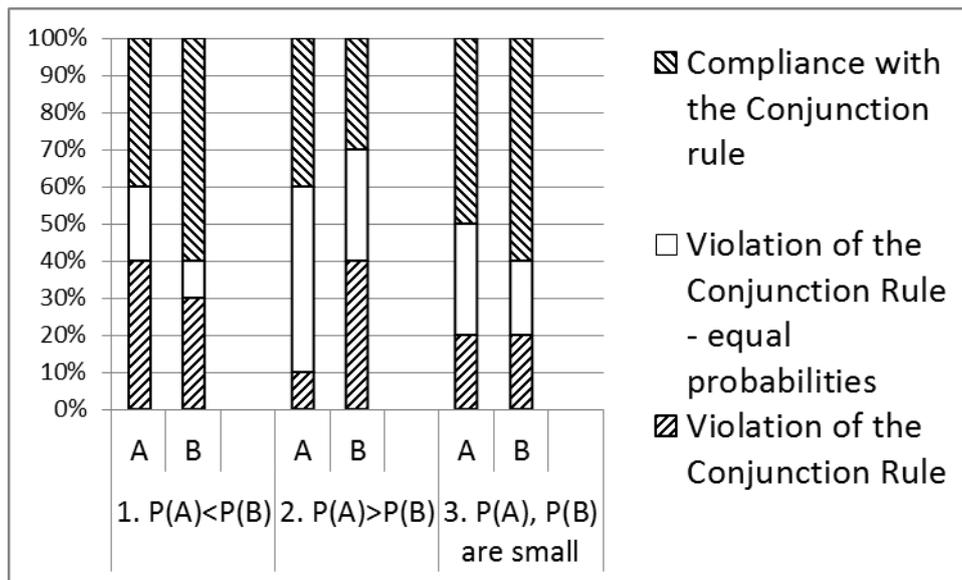


FIGURE 4. PERCENTAGE OF DIFFERENT TYPES OF ANSWERS SHOWING COMPLIANCE AND VIOLATION OF THE CONJUNCTION RULE - $P(A \& B)$ AS COMPARED TO $P(A)$ OR $P(B)$ - DEPENDING ON TASK SITUATIONS FOR TAIWANESE SUBJECTS.

At the same time the number of people which prefer either one event or two events as well as people having no this preference stay relatively large in all tasks. This in our opinion means that different tendencies of perception coexist in population providing variability of human behaviour in similar situations.

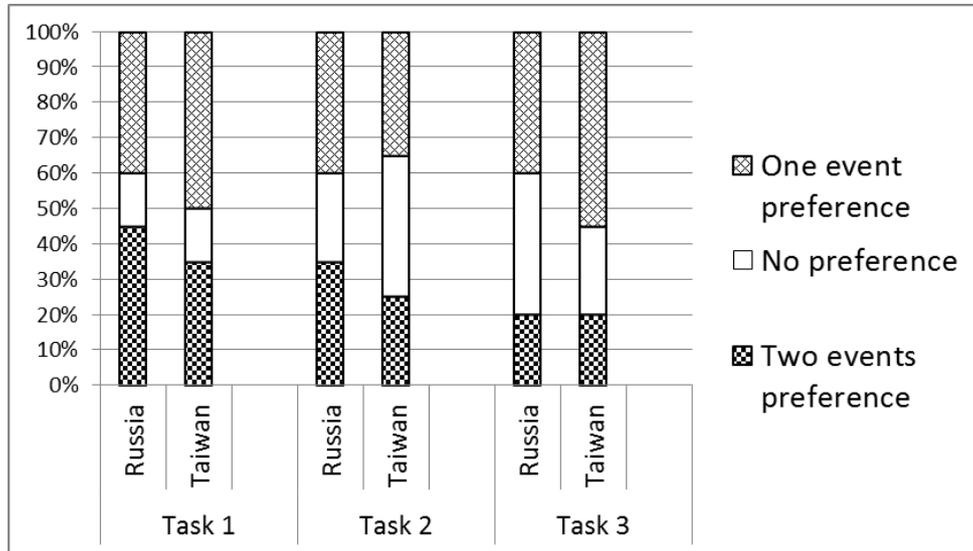


FIGURE 5. RELATIVE PERCENTAGES OF ANSWERS' PREFERENCES FOR ONE (A OR B) AND TWO (A&B) EVENTS DEPENDING ON TASK SITUATIONS FOR RUSSIA AND TAIWAN.

The results of the study are experimental and are based on pilot data. Nevertheless they may be useful for further research and improvement of the questionnaire.

5. DISCUSSION

According to presented cross-cultural study there are certain cultural differences between the Russians and the Taiwanese in the estimates of the probability of joint events. In particular, Taiwanese subjects generally demonstrated appropriate behaviour closer adherence to the Conjunction Rule. It may seem strange to the Chinese people, who from a cultural point of view, should be closer to a holistic way of thinking than the Europeans. The explanation for this peculiarity is the fact that Chinese people in Taiwan are already heavily Americanized and have quite embraced value attitudes of the Western world. It is known that many people of the East "strive to the West" and thus even acquire Western quality to a greater extent than is expressed in the West [9].

At the same time the variability of the Taiwanese behaviour is higher. For example, one of the Taiwanese subjects considered all the events in all the tasks equally probable, that is, in all cases has chosen equal probabilities. Among Russian subjects such behaviour was absent.

On the whole experiments show that variability of human behaviour is significant and that it is possible to adjust experimental conditions to receive people answers connected with higher or lower compliance with the Conjunction Rule. This has also been shown in our earlier experiment [4].

This behaviour in fact doesn't mean that human decisions specifically follow the Conjunction Rule. Probability judgments are mostly fulfilled on the level of rather broad specific set of criteria. Human judgments are based on a perceptual and affective tendencies expressed in a causal set of multiple notions like representativeness, importance, believability, applicability, correspondence, conceivability, trustworthiness, reliability, etc. [7]. In this cross-cultural experiment together with the perceptual co-representation of the events important reference for the test were the logical values of the ratio of answers offered for selection. All this leads to a wide spread in the sample response.

Thus it is possible to state that formal probability judgment may be the one but not necessary the most important and commonly used technique of choice. In assessing the probability people can intuitively consider the semantics of many situational factors and possible causal relationships, including

ANALYTICAL MANAGEMENT

the relative reliability, co-representation and the actual degree of occurrence (plausibility) of the respective events.

On the other hand the formal model determining the probability of random events is not exclusive and the only correct model for the estimation of probabilities as it belongs to a very simplified system of event. In this regard, one can question the use of this model and the rules for combining the probabilities as the basis for determining the correct behaviour when assessing the probability of hypothetical real events. In our opinion, the application of the criteria of the classical probability theory as the rules for evaluation of human behaviour in the face of uncertainty is not correct. In psychological practice we are faced with a different model of reality based on the perceptual heuristics, affective and semantic trends expressed in a variety of cause-related concepts and intentions, which include co-representation conditions, general causal schemes and situational hints (clues) as well as their intuitive and logical meanings [4, 7].

6. CONCLUSION

Heuristics and regulatory scientific judgments can be considered essential invariants of intercultural communication, which are formed in the process of education and contributed significantly to the ordinary psychological processes in different cultures, as well as the processes of scientific thinking in psychology and other sciences. In particular, the now-familiar scientific concepts are often used as standards and criteria in evaluating the truth of human psychology. It is noted that this is not always adequate to reality and can lead to a kind of scientific errors and illusions, which are persistent, due to the generally recognized the importance and significance of scientific and technological knowledge.

In particular, the normative model for calculation of probabilities of random events is used as a criterion for the correctness of the behaviour, which is defined by the availability and representativeness heuristics. [12, 13]. So, it is often stated that heuristics lead to incorrect results that they are opposed to scientific probability of judgment and are like the illusions of perception. This forms a misconception about heuristics, when their regularity is assessed in association with the mathematical model relating to a narrow group of phenomena a particular type or mechanism.

According to the concepts of transcendental psychology [5] the properties of perception as a basis of the representativeness heuristic ideas are to a large extent conditioned by the co-represented properties of the process of perception. This corresponds to a mathematical model, which theoretical implications are consistent with the experimental results of the perceptual heuristics.

The above shows that, from the point of view of the probability theory, the comparison of probabilities of an event A with the union of events A & B may be not on the right side depending on the definition of the overall set of elementary events. The developed mathematical model of co-represented events demonstrates that the probability of joined events may well exceed the probability of certain random events. Then the issue of verification of heuristics using standard scientific judgment has a different solution. The Conjunction Fallacy problem is removed on the basis of erroneous recognition of a classical probabilistic model as a universal model for probability estimations in the field of psychological reality. The proposed new mathematical model based on co-represented events is more consistent with the perceptual heuristic results and thus partly also can be used to explain them. In this regard, it can be argued that the Conjunction Fallacy is not an error of the people being tested. It is rather stereotyped researchers' error, taking a basic scientific theory as the norm, where its application is not completely justified. As shown in the work, the subjects in this case just perfectly logical and consistent in their beliefs about the probability of associated events: often quite naturally suggesting that two events have higher probability to occur than each of these certain events.

This suggests that the Conjunction Fallacy is a sort of scientific illusion. It may be regarded as an illusion as it is based on the wrong presupposition. The basic concept of illusion has been seen as a splitting between real performance and normative competence. Researchers often see classical models as norms against which human reasoning can be evaluated (rather than as codifications of it): when the two diverge, it is concluded that there is something wrong with the reasoning, not with the norms.

ANALYTICAL MANAGEMENT

This type of understanding of illusive phenomena is common in many sciences connected with psychic activities. When standard scientific conceptions differ fundamentally from common human behaviour it is reasonable to check the limits of scientific models which are used as a matter of right and valid norms. It means that for instance scientific probability norms of contemporary cross-cultural communication and education processes have to be adjusted to fit complex reality of human perception.

In general, we can conclude that human decisions under uncertainty is a multi-functional process that is characterized by the coexistence of different (conscious and unconscious) trends contributing to the perceptual and cognitive ability to perceive, understand and recognize the phenomenon of objects and situations, and to disclose the content of the outside ambient. Individual game and interaction of these trends in the case of poorly defined situations is manifested in the presence of a large variety of multi-valued variations in responses, significantly dependent on contextual influences.

The resulting probability values shown in cross-cultural and other experiments [4] are largely determined by situational preferences, taking into account various possible alternatives (including logical negative, neutral and positive situational conditions). These conditions are caused by the proposed description and presented features or retrieved directly from the proposed tasks. Without the presence of a special mathematical context different subjects naturally conceptualize the word "probability" in a multi-valued way. Therefore, the tendency to consider pure mathematical representation of the probability does not play a big role in decision-making. The model of reasoning according to the rules of probability theory, of course, may be presented among the above trends. However, this kind of thinking is not a priority because it refers to a specific group of phenomena of reality, and is unlikely to be evolutionarily significant. In part, it becomes socially relevant in modern education, yet this process is not widespread.

In this regard, the acceptance of the rules of special and obviously a simplified common model of calculation of the probabilities of independent random events as the standard for assessing the psychological processes does not seem natural. Moreover the research shows that this norm does not correspond to multivalued reality. The use of this normative behaviour outside the bounds of its applicability and its acceptance as a universal criterion applicable to the reality of any accidental events is leading to the emergence of a scientific illusion. Regulatory scientific definition of rational behaviour is projected on the psychology of human decision-making under explicitly or implicitly defined uncertainty, i.e. in an area that is far from the direct applicability of this behaviour, and is regarded as actually correct behaviour that is universally applicable to any particular circumstances.

A person's ability to learn and acquire new stereotypes in this case acts as an additional factor in favour of the relevant law-making and the possibility to follow the scientific norm of behaviour that demonstrate people specially trained in probability theory. The general nature of scientific theory in this case is sufficient to justify the possibility of its universal application.

The considered alternative mathematical model of joint probability of co-represented events is more valid psychologically and may be useful for better assessment of the representativeness and availability heuristics (used when making judgments about the probability of an event under uncertainty) and setting scientific standards for evaluation of psychology of human behaviour - standards, which are commonly used in cross-cultural communication and education processes.

REFERENCES

- [1] Aerts D., Aerts S. (2004) Towards a general operational and realistic framework for quantum mechanics and relativity theory. In A. C. Elitzur, S. Dolev and N. Kolenda (Eds.), *Quo Vadis Quantum Mechanics? Possible Developments in Quantum Theory in the 21st Century*. Berlin: Springer, 2004.
- [2] Artemenkov S. L. (2005) Embodied Cognition & Transcendental Psychology: Understanding the underlying processes of embodied cognition plasticity requires a new methodological paradigm. 2005 International Symposium on Body and Cognition: A Multidisciplinary Perspective. Taipei, Taiwan, NTU pp. 9-1 – 9-22.
- [3] Artemenkov S.L. (2005) The origins of sensory awareness: Perception as a generative system.

ANALYTICAL MANAGEMENT

Workshop on Action, Perception and Consciousness & The 10-th Workshop on Attention and Perception. Taipei, Taiwan, NTU pp. 16-17.

- [4] Artemenkov S L. (2006) Kansei Versus Extensional Reasoning: The Scientific Illusion of The Conjunction Fallacy in Probability Judgment. Proceedings of the First International Workshop on Kansei, February 2-3, 2006, Fukuoka, Japan, pp. 8-11.
- [5] Artemenkov S.L., Harris M. G. (2005) From Constancy & Polyfunctionality in Perception to the Transcendental Psychology approach: historical overview of a novel psychological paradigm. *Journal of Integrative Neuroscience*, 4(4), pp. 523–536.
- [6] Bennett M.J. (2005) Paradigmatic assumption of intercultural communication. Hillsboro: IDRInstitute. - URL:www.idrinstitute.org
- [7] Hertwig R., Gigerenzer G. (1999) The 'conjunction fallacy' revisited: how intelligent inferences look like reasoning errors. *Journal of Behavioral Decision Making*, 12, 275-305.
- [8] *Heuristics & Biases: the psychology of intuitive judgement* (2002) / edited by T.Gilovich, D.Griffin, D.Kahneman. Cambridge University Press. – 857 p.
- [9] Nisbett R.E. (2003) *The Geography of Thought*. Nicholas Brealey Publishing. London. – 263 p.
- [10] Peterson J.B. (1999) *Maps of Meaning: The Architecture of Belief*. New York: Routledge. 1999. – 544 p.
- [11] Piatelli-Palmarini M. (1994) *Inevitable Illusions*. John Wiley & Sons. – 242 p.
- [12] Tversky A., Kahneman D. (1974) Judgment under uncertainty: Heuristics and biases. *Science*, 185, pp. 1124-1131.
- [13] Tversky A., Kahneman D. (1983) Extensional vs. intuitive reasoning: The conjunction fallacy in probability judgment. *Psychological Review*, 90, pp. 293-315.
- [14] Watzlawick P., Beavin J., Jackson D. (1967) *Pragmatics of Human Communication: A study of interactional patterns, pathologies, and paradoxes*. New York: Norton, pp. 48-71.